ENERGY STAR Qualified Homes 2011
Savings & Cost Estimate Summary

The savings and incremental costs of implementing the ENERGY STAR Qualified Homes 2011 guidelines will vary for each individual home, dependent on variables such as baseline construction practices, geographic location, house design, and vendor relationships. For example, builders may experience much lower incremental costs where they are already using above-code windows or equipment efficiencies, complying with code-required high-quality insulation installation not currently enforced, or do not install appliances or ceiling fans within their homes.

As a means of developing ***illustrative*** savings and costs, EPA evaluated six typical homes across hot, mixed, and cold climates. The baseline configurations were roughly aligned with the 2006 IECC as currently enforced and the improved homes were aligned with the requirements of the prescriptive path of the 2011 guidelines, referred to as the ENERGY STAR Reference Design.

Because not all of the features proposed for the 2011 guidelines are currently recognized or credited within RESNET's current implementation of the HERS guidelines (e.g., efficient water distribution systems), the real-world energy savings for each home was estimated through a two-step process.

First, each of the homes was modeled in REM/Rate software with all of the features recognized by RESNET's HERS guidelines and able to be entered into the software program.

Then, Improvement Factors were developed to account for the impacts of the quality-control checklists of the ENERGY STAR 2011 guidelines (i.e., Thermal Bypass Inspection, Quality Framing, HVAC Quality Installation, Indoor Air Quality, Water-Managed Construction) and the hot water efficiency measures. Some of these factors were calculated from the results of additional parametric REM/Rate simulations with and without advanced conservation features (e.g., slightly improved duct efficiency, lower framing factors) and some were developed from engineering analyses external to REM/Rate (e.g., water conservation measures).

The Improvement Factors were used to modify the original REM/Rate energy load, consumption and cost outputs to final real-world savings estimates.

Incremental costs were estimated for each of the features required by the ENERGY STAR Reference Design as applied to each of the six homes. Costs were then summed across all features and compared to the costs of the current 2006 ENERGY STAR guidelines.

The following pages contain a summary of the incremental costs for each home, the savings for each home, and a supporting savings and cost document for each of the six checklists and one for the required hot water efficiency measures.

ENERGY STAR Qualified Homes 2011
Savings & Cost Estimate Summary

ENERGY STAR Qualified Homes 2011 Illustrative Savings Summar

Home	Climate	Location	Heating Fuel	Annual Utility Bills ($)		
				Costs		Savings
				2006 IECC	2011 ENERGY STAR	2011 ENERGY STAR
1	2	Phoenix, AZ	Electric	1,889	1,475	414
2	2	Orlando, FL	Electric	1,620	1,287	333
3	4	Lexington, KY	Gas	1,778	1,335	444
4	4 Marine	Seattle, WA	Gas	1,454	1,142	311
5	6	Chicago, IL	Gas	1,929	1,403	527
6	6	Minneapolis, MN	Gas	2,196	1,571	624
Population Weighted Average For These Six Homes				1,806	1,364	443

ENERGY STAR Qualified Homes 2011
Savings & Cost Estimate Summary

Incremental Costs for ENERGY STAR Qualified Homes 2011 - Sample Home 1

Major Housing Characteristics

Stories	One	**City**	Phoenix
Total Conditioned Floor Area (ft²)	2,200	**Climate Zone**	CZ 2
Conditioned Floor Area per Floor (ft²)	2,200	**Space Heating Fuel**	Elecctricity
Foundation Type	Slab	**Water Heating Fuel**	Elecctricity

Incremental Costs

Measure	Baseline Level	Efficient Level	Unit Cost	Cost Qty	Cost Unit	2006 ES Req?	2006 ES Cost	2011 ES Cost
ENERGY STAR Reference Design								
Cooling Equipment	(See Heating Equipment)	(See Heating Equipment)	-	-	-	-	-	-
Heating Equipment	7.7 HSPF / 13 SEER / 11 EER ASHP	8.2 HSPF / 14.5 SEER / 12 EER ASHP	$212.50	3.5	Tons	Yes	$744	$744
Radiant Barrier	No Radiant Barrier	Radiant Barrier	$390.00	1	Radiant Barrier	No	-	$390
Ceiling Insulation	R-30	R-30	-	-	-	-	-	-
Ceiling Insulation Installation	Grade II Installation	Grade I Installation	$0.03	2,200	Ins. Surface Area (ft^2)	Yes	$56	$56
Above-Grade Wall Insulation	R-13	R-13	-	-	-	-	-	-
A-G Wall Insulation Installation	Grade III Installation	Grade I Installation	$0.10	1,314	Ins. Surface Area (ft^2)	Yes	$128	$128
Foundation Insulation	No Slab Insulation	No Slab Insulation	-	-	-	-	-	-
Foundation Insulation Installation	Grade I Installation	Grade I Installation	-	-	-	-	-	-
Infiltration	8.5 ACH50	7.0 ACH50	$0.25	2,200	CFA (ft^2)	Yes	$550	$550
Windows	U-value: 0.75 / SHGC: 0.40	U-value: 0.55 / SHGC: 0.35	$1.00	396	Window Area (ft^2)	Yes	$396	$396
Doors	R-1.3 Door Insulation	R-2.5 Door Insulation	$25.00	2	Door	Yes	$50	$50
Water Heater	0.90 EF Electric DHW, 52 Gallons	0.92 EF Electric DHW, 52 Gallons	$55.00	1	Water Heater	Yes	$55	$55
Water Distribution	Standard Water Distribution System	Manifold, Core, or Demand System	$366.00	1	Home	No	-	$366
Low-Flow Showerheads	Standard Showerhead	2.0 gpm Showerhead	$15.00	2	Showerheads	No	-	$30
Thermostat	Manual Thermostat	Programmable Thermostat	$19.00	1	Thermostat	Yes	$19	$19
Duct Sealing	10 CFM per 100 ft² of CFA	4 CFM per 100 ft² of CFA	$100.00	2.2	1,000 CFA (ft²)	Yes	$220	$220
Duct Insulation	R-8 Attic, R-6 Other Uncond. Spaces	R-8 Attic, R-6 Other Uncond. Spaces	-	-	-	-	-	-
Dishwasher	Standard Efficiency Dishwasher	ENERGY STAR Dishwasher	$0.00	1	Dishwasher	No	-	$0
Refrigerator	Standard Efficiency Refrigerator	ENERGY STAR Refrigerator	$30.00	1	Refrigerator	No	-	$30
Ceiling Fans	Standard Efficiency Ceiling Fans	ENERGY STAR Ceiling Fans	$86.00	2	Ceiling Fans	No	-	$172
Lighting	10% ENERGY STAR Lighting	80% ENERGY STAR Lighting	$3.00	31	Lamps	No	-	$94
Bathroom Exhaust Fans	Standard Efficiency Exhaust Fans	ENERGY STAR Exhaust Fans	$100.00	2	Exhaust Fans	No	-	$200
ENERGY STAR Checklists								
Thermal Bypass						Yes	$250	$250
Quality Framing						No	-	$50
HVAC Quality Install. - Contractor						No	-	$400
HVAC Quality Install. - Rater						No	-	$50
Indoor Air Quality						No	-	$500
Water Managed Construction						No	-	$200
			Full Incremental Cost for Home				**$2,468**	**$4,950**

ENERGY STAR Qualified Homes 2011
Savings & Cost Estimate Summary

Incremental Costs for ENERGY STAR Qualified Homes 2011 - Sample Home 2

Major Housing Characteristics

Stories	One	**City**	Orlando
Total Conditioned Floor Area (ft²)	2,200	**Climate Zone**	CZ 2
Conditioned Floor Area per Floor (ft²)	2,200	**Space Heating Fuel**	Elecctricity
Foundation Type	Vented Crawlspace	**Water Heating Fuel**	Elecctricity

Incremental Costs

Measure	Baseline Level	Efficient Level	Unit Cost	Cost Qty	Cost Unit	2006 ES Req?	2006 ES Cost	2011 ES Cost
ENERGY STAR Reference Design								
Cooling Equipment	(See Heating Equipment)	(See Heating Equipment)	-	-	-	-	-	-
Heating Equipment	7.7 HSPF / 13 SEER / 11 EER ASHP	8.2 HSPF / 14.5 SEER / 12 EER ASHP	$212.50	3.5	Tons	Yes	$744	$744
Radiant Barrier	No Radiant Barrier	Radiant Barrier	$390.00	1	Radiant Barrier	No	-	$390
Ceiling Insulation	R-30	R-30	-	-	-	-	-	-
Ceiling Insulation Installation	Grade II Installation	Grade I Installation	$0.03	2,200	Ins. Surface Area (ft^2)	Yes	$56	$56
Above-Grade Wall Insulation	R-13	R-13	-	-	-	-	-	-
A-G Wall Insulation Installation	Grade III Installation	Grade I Installation	$0.10	1,314	Ins. Surface Area (ft^2)	Yes	$128	$128
Foundation Insulation	R-13 Floor Insulation	R-13 Floor Insulation	-	-	-	-	-	-
Foundation Insulation Installation	Grade III Installation	Grade I Installation	$0.07	2,200	Ins. Surface Area (ft^2)	Yes	$160	$160
Infiltration	9.0 ACH50	7.0 ACH50	$0.25	2,200	CFA (ft^2)	Yes	$550	$550
Windows	U-value: 0.75 / SHGC: 0.40	U-value: 0.55 / SHGC: 0.35	$1.00	396	Window Area (ft^2)	Yes	$396	$396
Doors	~R-1.5 Door Insulation	R-1.5 Door Insulation	-	-	-	-	-	-
Water Heater	0.90 EF Electric DHW, 52 Gallons	0.92 EF Electric DHW, 52 Gallons	$55.00	1	Water Heater	Yes	$55	$55
Water Distribution	Standard Water Distribution System	Manifold, Core, or Demand System	$366.00	1	Home	No	-	$366
Low-Flow Showerheads	Standard Showerhead	2.0 gpm Showerhead	$15.00	2	Showerheads	No	-	$30
Thermostat	Manual Thermostat	Programmable Thermostat	$19.00	1	Thermostat	Yes	$19	$19
Duct Sealing	10 CFM per 100 ft² of CFA	4 CFM per 100 ft² of CFA	$100.00	2.2	1,000 CFA (ft²)	Yes	$220	$220
Duct Insulation	R-8 Attic, R-6 Other Uncond. Spaces	R-8 Attic, R-6 Other Uncond. Spaces	-	-	-	-	-	-
Dishwasher	Standard Efficiency Dishwasher	ENERGY STAR Dishwasher	$0.00	1	Dishwasher	No	-	$0
Refrigerator	Standard Efficiency Refrigerator	ENERGY STAR Refrigerator	$30.00	1	Refrigerator	No	-	$30
Ceiling Fans	Standard Efficiency Ceiling Fans	ENERGY STAR Ceiling Fans	$86.00	2	Ceiling Fans	No	-	$172
Lighting	10% ENERGY STAR Lighting	80% ENERGY STAR Lighting	$3.00	31	Lamps	No	-	$94
Bathroom Exhaust Fans	Standard Efficiency Exhaust Fans	ENERGY STAR Exhaust Fans	$100.00	2	Exhaust Fans	No	-	$200
ENERGY STAR Checklists								
Thermal Bypass						Yes	$250	$250
Quality Framing						No	-	$50
HVAC Quality Install. - Contractor						No	-	$400
HVAC Quality Install. - Rater						No	-	$50
Indoor Air Quality						No	-	$500
Water Managed Construction						No	-	$200
			Full Incremental Cost for Home				**$2,577**	**$5,060**

ENERGY STAR Qualified Homes 2011
Savings & Cost Estimate Summary

Incremental Costs for ENERGY STAR Qualified Homes 2011 - Sample Home 3

Major Housing Characteristics

Stories	Two	**City**	Lexington
Total Conditioned Floor Area (ft²)	2,200	**Climate Zone**	CZ 4
Conditioned Floor Area per Floor (ft²)	1,100	**Space Heating Fuel**	Gas
Foundation Type	Unconditioned Basement	**Water Heating Fuel**	Gas

Incremental Costs

Measure	Baseline Level	Efficient Level	Unit Cost	Cost Qty	Cost Unit	2006 ES Req?	2006 ES Cost	2011 ES Cost
ENERGY STAR Reference Design								
Cooling Equipment	13 SEER Central AC	13 SEER Central AC	-	-	-	-	-	-
Heating Equipment	80 AFUE gas furnace	92 AFUE gas furnace	$12.44	40	kBtu/h	Yes	$498	$498
Radiant Barrier	No Radiant Barrier	No Radiant Barrier	-	-	-	-	-	-
Ceiling Insulation	R-38	R-38	-	-	-	-	-	-
Ceiling Insulation Installation	Grade II Installation	Grade I Installation	$0.03	1,100	Ins. Surface Area (ft^2)	Yes	$28	$28
Above-Grade Wall Insulation	R-13	R-13	-	-	-	-	-	-
A-G Wall Insulation Installation	Grade III Installation	Grade I Installation	$0.10	2,034	Ins. Surface Area (ft^2)	Yes	$198	$198
Foundation Insulation	R-19 Floor Insulation	R-19 Floor Insulation	-	-	-	-	-	-
Foundation Insulation Installation	Grade III Installation	Grade I Installation	$0.08	2,200	Ins. Surface Area (ft^2)	Yes	$182	$182
Infiltration	8.5 ACH50	6.0 ACH50	$0.25	2,200	CFA (ft^2)	Yes	$550	$550
Windows	U-value: 0.40 / SHGC: 0.40	U-value: 0.40 / SHGC: 0.40	-	-	-	-	-	-
Doors	R-2.5 Door Insulation	R-2.5 Door Insulation	-	-	-	-	-	-
Water Heater	0.59 EF gas DHW, 40 gallons	0.61 EF gas DHW, 40 gallons	$35.00	1	Water Heater	Yes	$35	$35
Water Distribution	Standard Water Distribution System	Manifold, Core, or Demand System	$366.00	1	Home	No	-	$366
Low-Flow Showerheads	Standard Showerhead	2.0 gpm Showerhead	$15.00	2	Showerheads	No	-	$30
Thermostat	Manual Thermostat	Programmable Thermostat	$19.00	1	Thermostat	Yes	$19	$19
Duct Sealing	10 CFM per 100 ft² of CFA	4 CFM per 100 ft² of CFA	$100.00	2.2	1,000 CFA (ft²)	Yes	$220	$220
Duct Insulation	R-8 Attic, R-6 Other Uncond. Spaces	R-8 Attic, R-6 Other Uncond. Spaces	-	-	-	-	-	-
Dishwasher	Standard Efficiency Dishwasher	ENERGY STAR Dishwasher	$0.00	1	Dishwasher	No	-	$0
Refrigerator	Standard Efficiency Refrigerator	ENERGY STAR Refrigerator	$30.00	1	Refrigerator	No	-	$30
Ceiling Fans	Standard Efficiency Ceiling Fans	ENERGY STAR Ceiling Fans	$86.00	2	Ceiling Fans	No	-	$172
Lighting	10% ENERGY STAR Lighting	80% ENERGY STAR Lighting	$3.00	31	Lamps	No	-	$94
Bathroom Exhaust Fans	Standard Efficiency Exhaust Fans	ENERGY STAR Exhaust Fans	$100.00	2	Exhaust Fans	No	-	$200
ENERGY STAR Checklists								
Thermal Bypass						Yes	$250	$250
Quality Framing						No	-	$50
HVAC Quality Install. - Contractor						No	-	$400
HVAC Quality Install. - Rater						No	-	$50
Indoor Air Quality						No	-	$500
Water Managed Construction						No	-	$200
			Full Incremental Cost for Home				**$1,980**	**$4,072**

ENERGY STAR Qualified Homes 2011
Savings & Cost Estimate Summary

Incremental Costs for ENERGY STAR Qualified Homes 2011 - Sample Home 4

Major Housing Characteristics

Stories	Two	**City**	Seattle
Total Conditioned Floor Area (ft²)	2,200	**Climate Zone**	CZ 4 Marine
Conditioned Floor Area per Floor (ft²)	1,100	**Space Heating Fuel**	Gas
Foundation Type	Vented Crawlspace	**Water Heating Fuel**	Gas

Incremental Costs

Measure	Baseline Level	Efficient Level	Unit Cost	Cost Qty	Cost Unit	2006 ES Req?	2006 ES Cost	2011 ES Cost
ENERGY STAR Reference Design								
Cooling Equipment	13 SEER Central AC	13 SEER Central AC	-	-	-	-	-	-
Heating Equipment	80 AFUE gas furnace	92 AFUE gas furnace	$12.44	40	kBtu/h	Yes	$498	$498
Radiant Barrier	No Radiant Barrier	No Radiant Barrier	-	-	-	-	-	-
Ceiling Insulation	R-38	R-38	-	-	-	-	-	-
Ceiling Insulation Installation	Grade II Installation	Grade I Installation	$0.03	1,100	Ins. Surface Area (ft^2)	Yes	$28	$28
Above-Grade Wall Insulation	R-19	R-20	$0.00	2,034	Ins. Surface Area (ft^2)	No	-	$0
A-G Wall Insulation Installation	Grade III Installation	Grade I Installation	$0.05	2,034	Ins. Surface Area (ft^2)	Yes	$102	$102
Foundation Insulation	R-30 Floor Insulation	R-30 Floor Insulation	-	-	-	-	-	-
Foundation Insulation Installation	Grade III Installation	Grade I Installation	$0.09	2,200	Ins. Surface Area (ft^2)	Yes	$198	$198
Infiltration	10.5 ACH50	6.0 ACH50	$0.25	2,200	CFA (ft^2)	Yes	$550	$550
Windows	U-value: 0.35 / SHGC: 0.40	U-value: 0.35 / SHGC: 0.40	-	-	-	-	-	-
Doors	R-2.9 Door Insulation	R-2.9 Door Insulation	-	-	-	-	-	-
Water Heater	0.59 EF gas DHW, 40 gallons	0.61 EF gas DHW, 40 gallons	$35.00	1	Water Heater	Yes	$35	$35
Water Distribution	Standard Water Distribution System	Manifold, Core, or Demand System	$366.00	1	Home	No	-	$366
Low-Flow Showerheads	Standard Showerhead	2.0 gpm Showerhead	$15.00	2	Showerheads	No	-	$30
Thermostat	Manual Thermostat	Programmable Thermostat	$19.00	1	Thermostat	Yes	$19	$19
Duct Sealing	10 CFM per 100 ft² of CFA	4 CFM per 100 ft² of CFA	$100.00	2.2	1,000 CFA (ft²)	Yes	$220	$220
Duct Insulation	R-8 Attic, R-6 Other Uncond. Spaces	R-8 Attic, R-6 Other Uncond. Spaces	-	-	-	-	-	-
Dishwasher	Standard Efficiency Dishwasher	ENERGY STAR Dishwasher	$0.00	1	Dishwasher	No	-	$0
Refrigerator	Standard Efficiency Refrigerator	ENERGY STAR Refrigerator	$30.00	1	Refrigerator	No	-	$30
Ceiling Fans	Standard Efficiency Ceiling Fans	ENERGY STAR Ceiling Fans	$86.00	2	Ceiling Fans	No	-	$172
Lighting	10% ENERGY STAR Lighting	80% ENERGY STAR Lighting	$3.00	31	Lamps	No	-	$94
Bathroom Exhaust Fans	Standard Efficiency Exhaust Fans	ENERGY STAR Exhaust Fans	$100.00	2	Exhaust Fans	No	-	$200
ENERGY STAR Checklists								
Thermal Bypass						Yes	$250	$250
Quality Framing						No	-	$50
HVAC Quality Install. - Contractor						No	-	$400
HVAC Quality Install. - Rater						No	-	$50
Indoor Air Quality						No	-	$500
Water Managed Construction						No	-	$200
				Full Incremental Cost for Home			**$1,900**	**$3,992**

ENERGY STAR Qualified Homes 2011
Savings & Cost Estimate Summary

Incremental Costs for ENERGY STAR Qualified Homes 2011 - Sample Home 5

Major Housing Characteristics

Stories	Two	**City**	Chicago
Total Conditioned Floor Area (ft²)	2,200	**Climate Zone**	CZ 6
Conditioned Floor Area per Floor (ft²)	733	**Space Heating Fuel**	Gas
Foundation Type	Conditioned Basement	**Water Heating Fuel**	Gas

Incremental Costs

Measure	Baseline Level	Efficient Level	Unit Cost	Cost Qty	Cost Unit	2006 ES Req?	2006 ES Cost	2011 ES Cost
ENERGY STAR Reference Design								
Cooling Equipment	13 SEER Central AC	13 SEER Central AC	-	-	-	-	-	-
Heating Equipment	80 AFUE gas furnace	92 AFUE gas furnace	$12.44	40	kBtu/h	Yes	$498	$498
Radiant Barrier	No Radiant Barrier	No Radiant Barrier	-	-	-	-	-	-
Ceiling Insulation	R-49	R-49	-	-	-	-	-	-
Ceiling Insulation Installation	Grade II Installation	Grade I Installation	$0.03	733	Ins. Surface Area (ft^2)	Yes	$19	$19
Above-Grade Wall Insulation	R-19	R-20	$0.00	1,604	Ins. Surface Area (ft^2)	No	-	$0
A-G Wall Insulation Installation	Grade III Installation	Grade I Installation	$0.05	1,604	Ins. Surface Area (ft^2)	Yes	$80	$80
Foundation Insulation	R-13 Basement Wall Insulation	R-19 Basement Wall Insulation	$0.08	889	Ins. Surface Area (ft^2)	No	-	$67
Foundation Insulation Installation	Grade III Installation	Grade I Installation	$0.11	889	Ins. Surface Area (ft^2)	Yes	$100	$100
Infiltration	9.0 ACH50	5.0 ACH50	$0.25	2,200	CFA (ft^2)	Yes	$550	$550
Windows	U-value: 0.35 / SHGC: 0.40	U-value: 0.35 / SHGC: 0.40	-	-	-	-	-	-
Doors	R-2.9 Door Insulation	R-2.9 Door Insulation	-	-	-	-	-	-
Water Heater	0.59 EF gas DHW, 40 gallons	0.61 EF gas DHW, 40 gallons	$35.00	1	Water Heater	Yes	$35	$35
Water Distribution	Standard Water Distribution System	Manifold, Core, or Demand System	$366.00	1	Home	No	-	$366
Low-Flow Showerheads	Standard Showerhead	2.0 gpm Showerhead	$15.00	2	Showerheads	No	-	$30
Thermostat	Manual Thermostat	Programmable Thermostat	$19.00	1	Thermostat	Yes	$19	$19
Duct Sealing	10 CFM per 100 ft² of CFA	4 CFM per 100 ft² of CFA	$100.00	2.2	1,000 CFA (ft²)	Yes	$220	$220
Duct Insulation	R-8 Attic, R-6 Other Uncond. Spaces	R-8 Attic, R-6 Other Uncond. Spaces	-	-	-	-	-	-
Dishwasher	Standard Efficiency Dishwasher	ENERGY STAR Dishwasher	$0.00	1	Dishwasher	No	-	$0
Refrigerator	Standard Efficiency Refrigerator	ENERGY STAR Refrigerator	$30.00	1	Refrigerator	No	-	$30
Ceiling Fans	Standard Efficiency Ceiling Fans	ENERGY STAR Ceiling Fans	$86.00	2	Ceiling Fans	No	-	$172
Lighting	10% ENERGY STAR Lighting	80% ENERGY STAR Lighting	$3.00	31	Lamps	No	-	$94
Bathroom Exhaust Fans	Standard Efficiency Exhaust Fans	ENERGY STAR Exhaust Fans	$100.00	2	Exhaust Fans	No	-	$200
ENERGY STAR Checklists								
Thermal Bypass						Yes	$250	$250
Quality Framing						No	-	$50
HVAC Quality Install. - Contractor						No	-	$400
HVAC Quality Install. - Rater						No	-	$50
Indoor Air Quality						No	-	$500
Water Managed Construction						No	-	$200
			Full Incremental Cost for Home				**$1,771**	**$3,930**

ENERGY STAR Qualified Homes 2011
Savings & Cost Estimate Summary

Incremental Costs for ENERGY STAR Qualified Homes 2011 - Sample Home 6

Major Housing Characteristics

Stories	Two	**City**	Minneapolis
Total Conditioned Floor Area (ft²)	2,200	**Climate Zone**	CZ 6
Conditioned Floor Area per Floor (ft²)	733	**Space Heating Fuel**	Gas
Foundation Type	Conditioned Basement	**Water Heating Fuel**	Gas

Incremental Costs

Measure	Baseline Level	Efficient Level	Unit Cost	Cost Qty	Cost Unit	2006 ES Req?	2006 ES Cost	2011 ES Cost
ENERGY STAR Reference Design								
Cooling Equipment	13 SEER Central AC	13 SEER Central AC	-	-	-	-	-	-
Heating Equipment	80 AFUE gas furnace	92 AFUE gas furnace	$12.44	60	kBtu/h	Yes	$747	$747
Radiant Barrier	No Radiant Barrier	No Radiant Barrier	-	-	-	-	-	-
Ceiling Insulation	R-49	R-49	-	-	-	-	-	-
Ceiling Insulation Installation	Grade II Installation	Grade I Installation	$0.03	733	Ins. Surface Area (ft^2)	Yes	$19	$19
Above-Grade Wall Insulation	R-19	R-20	$0.00	1,604	Ins. Surface Area (ft^2)	No	-	-
A-G Wall Insulation Installation	Grade III Installation	Grade I Installation	$0.05	1,604	Ins. Surface Area (ft^2)	Yes	$80	$80
Foundation Insulation	R-13 Basement Wall Insulation	R-19 Basement Wall Insulation	$0.08	889	Ins. Surface Area (ft^2)	No	-	$67
Foundation Insulation Installation	Grade III Installation	Grade I Installation	$0.11	889	Ins. Surface Area (ft^2)	Yes	$100	$100
Infiltration	8.0 ACH50	5.0 ACH50	$0.25	2,200	CFA (ft^2)	Yes	$550	$550
Windows	U-value: 0.35 / SHGC: 0.40	U-value: 0.35 / SHGC: 0.40	-	-	-	-	-	-
Doors	R-2.9 Door Insulation	R-2.9 Door Insulation	-	-	-	-	-	-
Water Heater	0.59 EF gas DHW, 40 gallons	0.61 EF gas DHW, 40 gallons	$35.00	1	Water Heater	Yes	$35	$35
Water Distribution	Standard Water Distribution System	Manifold, Core, or Demand System	$366.00	1	Home	No	-	$366
Low-Flow Showerheads	Standard Showerhead	2.0 gpm Showerhead	$15.00	2	Showerheads	No	-	$30
Thermostat	Manual Thermostat	Programmable Thermostat	$19.00	1	Thermostat	Yes	$19	$19
Duct Sealing	10 CFM per 100 ft² of CFA	4 CFM per 100 ft² of CFA	$100.00	2.2	1,000 CFA (ft²)	Yes	$220	$220
Duct Insulation	R-8 Attic, R-6 Other Uncond. Spaces	R-8 Attic, R-6 Other Uncond. Spaces	-	-	-	-	-	-
Dishwasher	Standard Efficiency Dishwasher	ENERGY STAR Dishwasher	$0.00	1	Dishwasher	No	-	$0
Refrigerator	Standard Efficiency Refrigerator	ENERGY STAR Refrigerator	$30.00	1	Refrigerator	No	-	$30
Ceiling Fans	Standard Efficiency Ceiling Fans	ENERGY STAR Ceiling Fans	$86.00	2	Ceiling Fans	No	-	$172
Lighting	10% ENERGY STAR Lighting	80% ENERGY STAR Lighting	$3.00	31	Lamps	No	-	$94
Bathroom Exhaust Fans	Standard Efficiency Exhaust Fans	ENERGY STAR Exhaust Fans	$100.00	2	Exhaust Fans	No	-	$200
ENERGY STAR Checklists								
Thermal Bypass						Yes	$250	$250
Quality Framing						No	-	$50
HVAC Quality Install. - Contractor						No	-	$400
HVAC Quality Install. - Rater						No	-	$50
Indoor Air Quality						No	-	$500
Water Managed Construction						No	-	$200
			Full Incremental Cost for Home				**$2,020**	**$4,179**

ENERGY STAR Qualified Homes 2011
Savings & Cost Estimate Summary

Measure	Cost Reference
ENERGY STAR Reference Design	
Heating Equipment	Navigant Consulting. EIA - Technology Forecast Updates - Residential and Commercial Building Technologies - Reference Case Second Edition (Revised). Reference number 20070831.1. 2007. Average costs were used. Costs were linearly interpolated for 14.5 SEER/ 8.5 HSPF heat pump and 92 AFUE gas furnace.
Radiant Barrier	Nadel, Sachs, et al. Emerging Energy-Saving Technologies & Practices for the Buildings Sector as of 2004. Report Number A042. ACEEE, 2004.
Above-Grade Wall Insulation	Reed Construction Data, Inc.. RSMeans Residental Cost Data. 25th Annual Edition, 2006. Baseline cost for R-19 batt insulation estimated from Section 7210, Sub-Section 950, Measure 141. Upgrade cost for R-20 blown-in cellulose insulation interpolated from Section 7210, Sub-Section150, measures 0030 and 0050. As a result of predicted negative incremental cost, a conservative estimate of zero incremental cost was assumed.
Foundation Insulation	Reed Construction Data, Inc.. RSMeans Residental Cost Data. 25th Annual Edition, 2006. Baseline cost for R-13 batt insulation interpolated from Section 7210, Sub-Section 950, measures 0821 and 0861. Upgrade cost for R-19 batt insulation estimated from Section 7210, Sub-Section 950, Measure 0861.
Insulation Installation	Reed Construction Data, Inc.. RSMeans Residental Cost Data. 25th Annual Edition, 2006. Incremental costs for higher-quality insulation installation reflected by using higher labor costs. Assumption of 15% ceiling insulation labor increase from Grade II to Grade I, 25% floor insulation labor increase from Grade III to Grade I, 75% fiberglass frame wall insulation labor increase from Grade III to Grade I, and 25% blown-in frame wall insulation labor increase from Grade III to Grade I where baseline labor costs were dervied from RS Means. Baseline wall costs for cold climates from Section 7210, Sub-Section 150, measures 0030 & 0050 and from Sub-Section 950, Measures 0821 and 0861 for mixed and hot climates. Baseline ceiling costs from Section 7210, Sub-Section 950, Measures 0901 and 0941. Baseline floor costs from Section 7210, Sub-Section 350, Measures 2100, 2150, & 2200. Linear interpolation used as needed to estimate costs for unlisted insulation levels.
Infiltration	Estimated market costs based on anecdotal evidence.
Windows	Estimated market costs based on anecdotal evidence.
Doors	Estimated market costs based on anecdotal evidence.
Water Heater	Navigant Consulting. EIA - Technology Forecast Updates - Residential and Commercial Building Technologies - Reference Case Second Edition (Revised). Reference number 20070831.1. 2007. Average costs were used. Cost was linearly interpolated for 0.92 EF gas DHW unit.
Water Distribution	United States EPA. ENERGY STAR Qualified Homes 2011 Water Efficiency Measures Savings & Cost Estimate. 2009.
Low-Flow Showerheads	CA Energy Comission and CA Public Utilities Commission. Database for Energy Efficient Resources. Measure ID D03-937. 2005.
Thermostat	United States EPA. Life Cycle Cost Estimate for 1 ENERGY STAR Qualified Programmable Thermostat(s). Accessed at http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorProgrammableThermostat.xls on April 6, 2009.
Duct Sealing	Connecticut Light & Power and The United Illuminating Company. CL&P and UI Program Savings Documentation for 2008 Program Year. 9/25/2007.
Dishwasher	United States EPA. Life Cycle Cost Estimate for 1 ENERGY STAR Qualified Dishwasher(s). Accessed at http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorConsumerDishwasher.xls on April 6, 2009.
Refrigerator	United States EPA. Life Cycle Cost Estimate for 1 ENERGY STAR Qualified Residential Refrigerator(s). Accessed at http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/Consumer_Residential_Refrig_Sav_Calc.xls on April 6, 2009.
Ceiling Fans	United States EPA. Life Cycle Cost Estimate for 1 ENERGY STAR Qualified Ceiling Fan(s) with Lighting. Accessed at http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/Ceiling_Fan_Savings_Calculator_Consumer.xls on April 6, 2009.
Lighting	United States EPA. Life Cycle Cost Estimate for 1 ENERGY STAR Qualified Compact Fluorescent Lamp(s). Accessed at http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorCFLs.xls on April 6, 2009.
Bathroom Exhaust Fans	Cost estimates obtained for one ENERGY STAR qualified and one non-qualified 80 CFM fan from the Home Depot website. Accessed on April 6, 2009. Non-qualified exhaust fan: http://www.homedepot.com/webapp/wcs/stores/servlet/ProductDisplay?storeId=10051&langId=-1&catalogId=10053&productId=100066718&N=10000003+500524+4294927428+1390+4294929930+10043007 Qualified exhaust fan: http://www.homedepot.com/webapp/wcs/stores/servlet/ProductDisplay?storeId=10051&langId=-1&catalogId=10053&productId=100385917&N=10000003+90043+500524+4294966899
ENERGY STAR Checklists	
Thermal Bypass	United States EPA. ENERGY STAR Qualified Homes 2011 Thermal Bypass Checklist Savings & Cost Estimate. 2009.
Quality Framing	United States EPA. ENERGY STAR Qualified Homes 2011 Quality Framing Checklist Savings & Cost Estimate. 2009.
HVAC Quality Install. - Contractor	United States EPA. ENERGY STAR Qualified Homes 2011 HVAC Quality Installation Contractor Checklist Savings & Cost Estimate. 2009.
HVAC Quality Install. - Rater	United States EPA. ENERGY STAR Qualified Homes 2011 HVAC Quality Installation Rater Checklist Savings & Cost Estimate. 2009.
Indoor Air Quality	United States EPA. ENERGY STAR Qualified Homes 2011 Indoor Air Quality Checklist Savings & Cost Estimate. 2009.
Water Managed Construction	United States EPA. ENERGY STAR Qualified Homes 2011 Water Managed Construction Checklist Savings & Cost Estimate. 2009.

ENERGY STAR Qualified Homes 2011
Thermal Bypass Inspection Checklist
Savings & Cost Estimate

Average Estimated Incremental Cost:

The net cost for the checklist is estimated to be $300.

Average Estimated Incremental Savings:

Energy savings of approximately 15% reduction in heating and cooling load and consumption are estimated as a result of the reduction in convective loops and in reduced conduction from properly insulated details.

Rationale:

Incremental costs for the thermal bypass checklist are comprised of added material and labor costs associated with implementing the checklist and an additional cost for third-party verification. Compliance costs vary widely depending on the percentage of requirements applicable to a particular home, the number of requirements not already being met through standard practice, the complexity of the home, and the strategies used for compliance. Over the past few years of implementation, EPA has received anecdotal evidence that average incremental costs for labor and material are approximately $175, including an assumed $50 for sealing sheetrock to the top plate in wall assemblies. Third-party inspection costs are estimated at an additional $125 per home.

Energy savings are also variable and difficult to assess. For example, the presence and impacts from convective loops, which may significantly degrade the performance of an insulated component, are not recognized nor the impacts quantified in typical energy simulation software. One study compared the real-world energy intensity of homes in Phoenix qualified under the original (i.e., 1995-2006) ENERGY STAR guidelines with those qualified under the Environments for Living (EFL) program. Some of the key differences in program requirements at that time were that EFL contained additional requirements similar to the thermal bypass checklist, such as an air-barrier and insulation field inspection. EFL homes were shown to have approximately 15% less summer energy consumption than the ENERGY STAR qualified homes and is used as the basis for the above estimate.

Supporting Documentation:

The reference for the study mentioned above is as follows:

Swanson, Colby. “Measuring Public Benefit from Energy Efficient Homes.” Advanced Energy, Raleigh, NC. 2005.

ENERGY STAR Qualified Homes 2011
Quality Framing Checklist
Savings & Cost Estimate

Average Estimated Incremental Cost:

It is expected that increased design, training, and inspection costs will be offset by material savings, yielding an incremental cost of zero. The assumed cost to complete the third-party inspection for the checklist is $

Average Estimated Incremental Savings:

It is assumed that a reduced framing fraction of 17% will be achieved for exterior walls and 7% will be achieved for ceilings. Average combined annual heating and cooling energy savings from advanced framing techniques have been shown to vary between roughly 3% and 5%.

Rationale:

The purpose of the ENERGY STAR Quality Framing Checklist is to reduce the impacts of thermal bridging over standard construction methods by decreasing the level of unnecessary framing and allowing more space for insulation to be installed. This is accomplished by requiring the builder to either adopt some of the key design techniques of optimum value engineered (OVE) walls or by using an advanced wall system such as SIP panels, Insulated Concrete Forms, or double-walls.

Incremental costs were conservatively estimated at zero, based upon an ACEEE study and EERE fact sheet, cited in the following section.

A conservative estimate of savings was determined by estimating the reduced framing fraction associated with the least aggressive measure (i.e., the key design techniques for OVE walls) and then modeling this reduced framing fraction in typical housing configurations. The estimation of representative framing fractions of walls and ceilings before and after the application of these techniques is illustrated below. The savings estimate was also compared with the results from an ACEEE study and EERE fact sheet. The proposed ENERGY STAR reduced framing fraction does not include all of the typical aspects of more-aggressive OVE practices (e.g. in-line framing, single top plate, two-stud corners) and so cannot reach framing levels as low as OVE. On the other hand, some partners will utilize other options available on the checklist, such as SIPs, which will result in even lower framing fractions.

Supporting Documentation:

According to the 2004 ACEEE *Emerging Technologies & Practices* study, homes with optimum value engineering (OVE) framing can experience ~1% cooling electricity savings and ~2% heating gas savings annually. The aggressive techniques outlined by ACEEE include 24" OC stud spacing, in-line framing, single top plate, two-stud corners, and ladder T-walls. According to the study, material cost savings would be neutrally offset by increased design and training costs. Savings were estimated relative to a standard 2x4 16" OC wall with 26.1% framing fraction.

The August 2000 *Advanced Wall Framing* Technology fact sheet released by EERE claims combined annual heating and cooling savings of up to 5% with the same construction techniques suggested by ACEEE. The fact sheet also estimated labor cost savings between 3% and 5% and material cost savings of $500 and $1,000 for 1,200 and 2,400 sqft homes, respectively. This equates to roughly $0.42 material savings per sqft of floor space.

ENERGY STAR Qualified Homes 2011
Quality Framing Checklist
Savings & Cost Estimate

The following RESNET table shows framing fraction values for both standard and advanced construction.

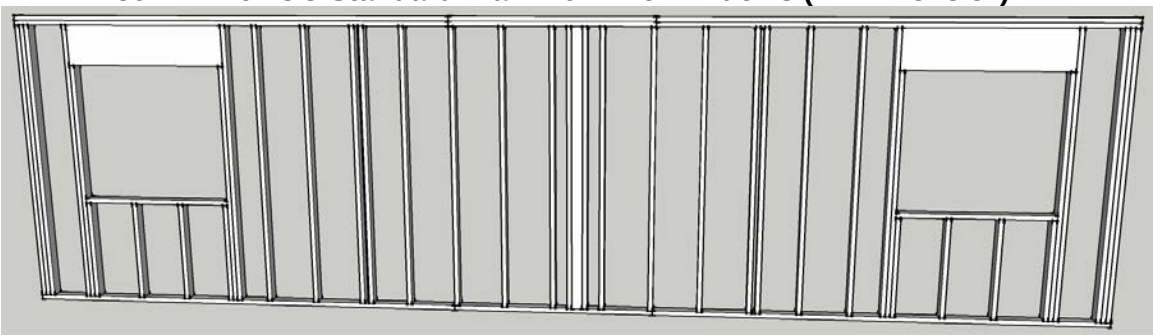
Table 303.4.1.3. Default Framing Fractions for Enclosure Elements

Enclosure Element	Frame Spacing (in. OC)	Default Frame Fraction (area)
Walls (standard):		
@16" OC	16	23%
@24" OC	24	20%
Walls (advanced):		
@16" OC	16	19%
@24" OC	24	16%
Structural Insulated Panels (SIPs)	48	10%
Ceilings (standard trusses):		
@16" OC	16	14%
@24" OC	24	11%
Ceilings (conventional framing):		
@16" OC	16	13%
@24" OC	24	9%
Ceilings (advanced trusses – raised heel):		
@16" OC	16	10%
@24" OC	24	7%

Source: 2006 Mortgage Industry National Home Energy Rating Systems Standards

The wall below has the same framing fraction as RESNET's default value for a standard wall with 16" OC framing.

30' 2x4 16" OC Standard Wall with Two Windows (4'-1" x 3'-8.5") [i,ii]

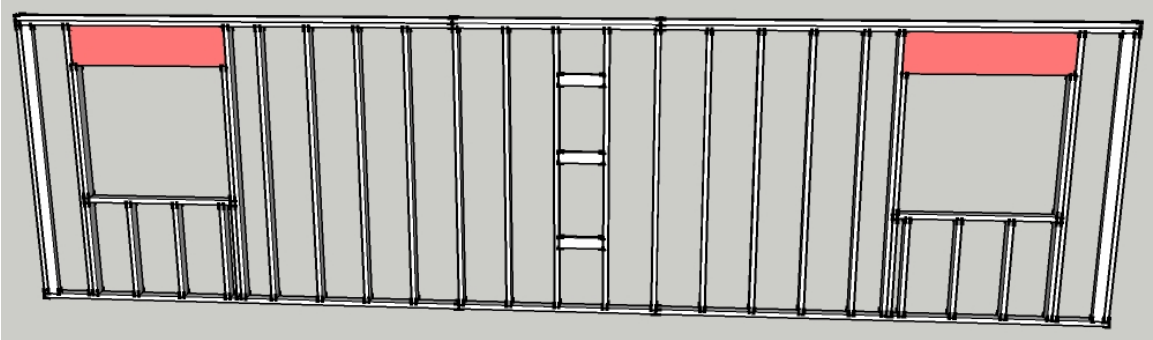


Top & Bottom Plates:	3 *30' * 1.5"	= 11.3 sqft
King Studs:	23 * 7'-7.5" * 1.5"	= 21.9 sqft
T-Wall Intersection:	7'-7.5" * 3.5"	= 2.2 sqft
4-Stud Corner:	4 * 7'-7.5" * 1.5"	= 3.8 sqft
Cripples & Jacks:	8 * 2'-8.5" * 1.5" + 4 * 6'-6.5" * 1.5"	= 6.0 sqft
Sills:	2 * 4'-1" * 1.5"	= 1.0 sqft
Header:	2 * 4'-4" * 11.5"	= 8.3 sqft
Total Wood Area		= 54.5 sqft
Framing Fraction	= 54.5 / (30 * 8)	= 23%

ENERGY STAR Qualified Homes 2011
Quality Framing Checklist
Savings & Cost Estimate

Below is a wall configuration that reflects a best-case application of the OVE techniques required by the framing checklist, which results in a framing fraction of 15%. The addition of complicated architectural characteristics would add to total framing fraction. Also, effective insulations levels will likely be reduced due to compression behind ladder t-wall framing and corner framing. It is therefore assumed that a higher framing fraction of approximately 17% will be achieved on average, which is equivalent to a 25% reduction from the RESNET standard of 23% framing fraction.

30' 2x6 16" OC ENERGY STAR Wall with Two Windows (4'-1" x 3'-8.5") [i,ii]

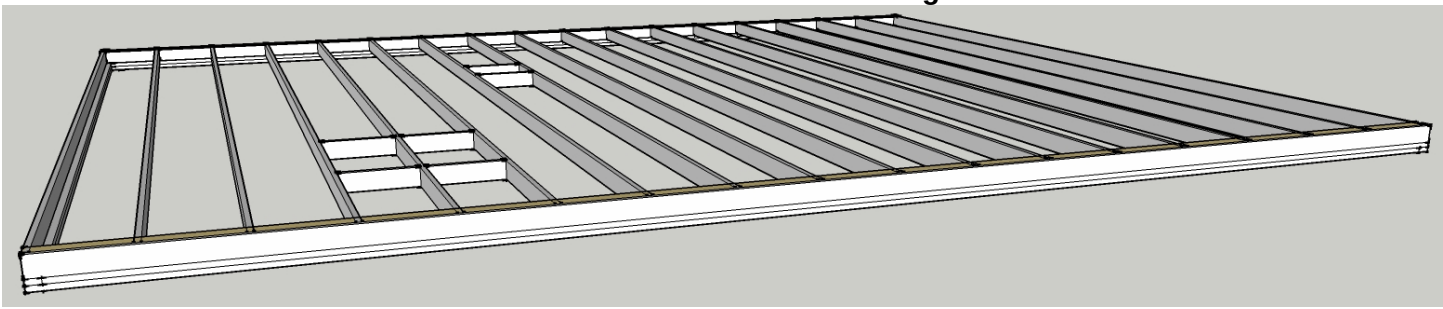


Top & Bottom Plates:	3 *30' * 1.5"	= 11.3 sqft
King Studs:	19 * 7'-7.5" * 1.5"	= 18.1 sqft
Ladder T-Wall Intersection:	3 * 16" * 3.5"	= Insulated
3-Stud Corner:	2 * 7'-7.5" * 3.5"	= Insulated
Cripples & Split Trimmers:	10 * 2'-8.5" * 1.5" + 4 * 3'-8.5" * 1.5"	= 5.2 sqft
Sills:	2 * 4'-4" * 1.5"	= 1.1 sqft
Header:	2 * 4'-4" * 11.5"	= Insulated
Total Wood Area		= 35.7 sqft
Framing Fraction	= 35.7 / (30 * 8)	= 15%

ENERGY STAR Qualified Homes 2011
Quality Framing Checklist
Savings & Cost Estimate

The ceiling below has the same framing fraction as RESNET's default value for a standard ceiling with 24" OC framing.

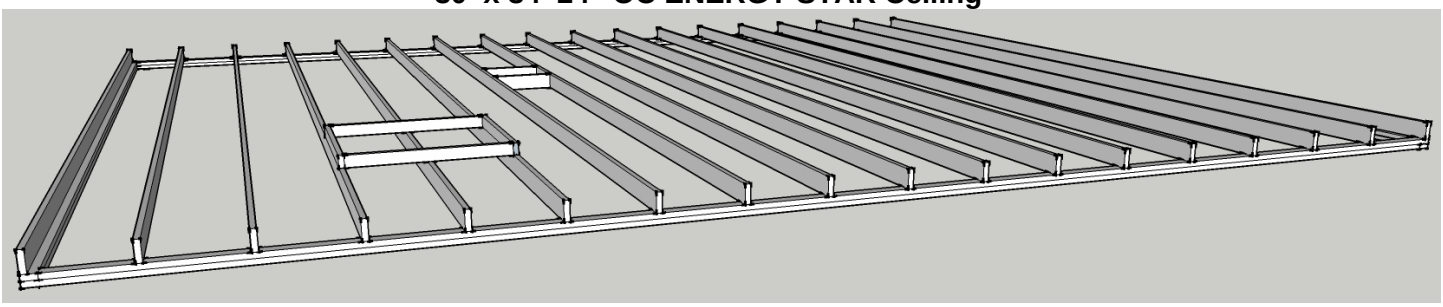
30' x 34' 24" OC Standard Ceiling [i,ii]



Rim Joists:	2 * 34' * 1.5"	= 8.5 sqft
Insulation Compression[iii]:	2 * 34' * 6"	= 34.0 sqft
Truss Components:	18 * 29'-9" * 1.5"	= 66.9 sqft
Attic Hatch:	2 * 1'-10.6" * 1.5"	= 0.5 sqft
HVAC Platform:	4 * 1'-10.6" * 1.5"	= 0.9 sqft
Total Wood Area		= 110.8 sqft
Framing Fraction	= 110.8 / (30 * 34)	= 11%

Below is a ceiling configuration that reflects the application of the OVE techniques required by the framing checklist, including raised-heel trusses and a raised HVAC platform, which results in a framing fraction of 7%. This reduced framing fraction matches RESNET's default value for an advanced raised-heel truss ceiling with 24" OC framing.

30' x 34' 24" OC ENERGY STAR Ceiling [i,ii]



Truss Components:	18 * 30' * 1.5"	= 67.5 sqft
Attic Hatch:	2 * 1'-10.6" * 1.5"	= 0.5 sqft
HVAC Platform:	2 * 3'-10. 5" * 1.5"	= Insulated
Total Wood Area		= 68.0 sqft
Framing Fraction	= 68.0 / (30 * 34)	= 7%

[i] *Framing components designed in Google SketchUp*

[ii] *Framing components are based on a two-story home with 2,000 sqft of conditioned floor area, approximately 1,000 sqft of attic floor space, and roughly 2,000 sqft of above-grade wall area.*

[iii] *It is assumed that insulation compression against roof sheathing near eaves results in effective increase in framing fraction.*

ENERGY STAR Qualified Homes 2011
HVAC Quality Installation Contractor Checklist
Savings & Cost Estimate

Average Estimated Incremental Cost:

The net cost for the checklist is estimated to be $400.

Average Estimated Incremental Savings:

Combined energy savings for complying with the right-sizing, proper air flow, and proper refrigerant charge components of the HVAC Quality Installation Contractor checklist are estimated to be 10% of heating consumption for combustion appliances, 19% of heating consumption for air-source heatpumps, and 19% of cooling consumption for heatpumps and air conditioners. In addition, savings from proper duct design and installation are estimated using a reduction in duct leakage from 4 to 3.4 CFM per 100 square feet of conditioned floor area (representing a 15% improvement).

Rationale:

The minimum cost for heat pump and central AC commissioning is approximately $125. An additional $25 cost for jump ducts or transfer grilles is also assumed. It is estimated that increased design efforts, required for compliance with ACCA Manual J, S, D, & T, will cost approximately $0.35 per square foot or approximately $750 for an average sized home. However, the increased cost for proper design is assumed to be partially offset with $500 in savings from a one ton reduction in equipment size.

Energy savings are based upon an ACEEE paper, cited below, that estimated the typical energy savings for proper sizing and commissioning of HVAC installations in new construction.

Supporting Documentation:

“CL&P and UI Program Savings Documentation for 2008 Program Year” states that the average minimum cost for the diagnostics step of heat pump or central AC commissioning is $125, though additional labor costs may apply depending on location, contractor, or any issues that may arise with refrigerant charge adjustment. Design costs of $0.35 per square foot of floor area are based upon an email exchange with Dennis Stroer, CalcsPlus, who provides a similar service. The cost savings for a one ton reduction in AC size is estimated using an average equipment cost per ton of approximately $500 based upon a Navigant Consulting document prepared for the Energy Information Administration entitled, “Technology Forecast Updates - Residential and Commercial Building Technologies - Reference Case Second Edition (Revised)”.

According to the 1999 ACEEE study “Energy Savings Potential from Addressing Residential Air Conditioner and Heat Pump Installation Problems,” the following are major contributors to potential HVAC and distribution system energy savings:

Characteristic	Energy Savings Potential
Equipment Sizing	2-10%
Airflow over Indoor Coil	7%
Refrigerant Charge	13%
Duct Leakage	10-15%

Due to interactive effects between equipment sizing, airflow, refrigerant charge, and duct leakage, however, individual energy savings are not directly additive. The ACEEE study suggests that typical energy savings for proper sizing, commissioning, and duct installation can result in average energy savings of about 35% for new construction installations. By subtracting the full duct leakage component from this estimate, a final savings value of about 19-20% is achieved. Savings for proper duct design, installation, and pressure-balancing are accounted for by assuming a 15% reduction in effective duct leakage from 4 to 3.4 CFM per 100 square foot of conditioned floor area.

ENERGY STAR Qualified Homes 2011
HVAC Quality Installation Rater Checklist
Savings & Cost Estimate

Average Estimated Incremental Cost:

The net cost for the checklist is estimated to be  .

Average Estimated Incremental Savings:

Savings associated with this checklist are captured within the savings estimate for the HVAC Quality Installation Contractor checklist.

Rationale:

The two new components of this checklist are the review of the completed HVAC Quality Installation Contractor checklist and a visual inspection of the duct system for pressure-balancing features and major defects in duct design and installation. It is expected that this can be completed within a half-hour of onsite inspection and an additional half hour of off-site coordination with the HVAC contractor.

Supporting Documentation:

2006 RS Means was used to estimate an hourly labor rate. An hourly rate of $46 for a skilled worker foreman, including overhead and profit, was assumed.

ENERGY STAR Qualified Homes 2011
Indoor Air Quality Checklist
Savings & Cost Estimate

Average Estimated Incremental Cost:

The net cost for the checklist is estimated to be $500.

Average Estimated Incremental Savings:

Energy savings are not anticipated as result of implementing the IAQ checklist. Additional energy used to provide the required ventilation is recognized by RESNET-accredited Home Energy Rating software programs and reflected in the resulting HERS index value.

Rationale:

The significant costs for compliance with the IAQ checklist are comprised of the ventilation equipment, the carbon monoxide detector, and the third-party inspection.

Ventilation strategies and associated costs will vary between homes. For this estimate, the cost an air-cycler with motorized damper was included at a cost of $125 with an additional $100 for installation. Exhaust-only strategies may be less expensive and systems with integrated energy management will be more expensive.

The cost of a carbon monoxide detector is estimated at $40 with an installation cost for hard-wired systems of $50.

The third-party inspection costs are estimated at $150.

Miscellaneous costs for items such as garage door gasketing and a compliant HVAC filter are estimated at $25

In all, the average estimated cost of compliance with the IAQ checklist is $500, with a wide amount of variation expected.

Supporting Documentation:

The cost of an air-cycler system with motorized damper was referenced from Eco-Smart's online store: http://www.ecosmartinc.com/catac9special.php

The average cost of a carbon monoxide detector was referenced from an article in Consumer Reports: http://www.consumerreports.org/cro/home-garden/home-improvement/home-security/carbon-monoxide-alarms/co-alarms-905/overview/

2006 RS Means was used to estimate an hourly labor rate. An hourly rate of $46 for a skilled worker foreman, including overhead and profit, was assumed.

ENERGY STAR Qualified Homes 2011
Water Managed Construction Checklist
Savings & Cost Estimate

Average Estimated Incremental Cost:

The net cost for the checklist is estimated to be $200.

Average Estimated Incremental Savings:

Energy savings are not anticipated as result of implementing the Water Managed checklist.

Rationale:

The requirements contained within the water-managed construction checklist are largely required by code. Therefore, the significant costs result from additional training, improved practices, and third-party inspection. Additional training and improved practices, which may require additional time, are expected to add approximately $100 per home. Third-party inspections to determine compliance with the checklist are also expected to add $100 per hor

ENERGY STAR Qualified Homes 2011
Water Efficiency Measures
Savings & Cost Estimate

Average Estimated Incremental Cost:

It is estimated that the average increase in design, materials, and installation costs for the water efficient distribution system and low-flow showerheads will be approximately $400.

System Type	Baseline Material	Upgrade Material	Assumed System Weighting	Baseline System Cost ($)	Efficient System Cost ($)	Incremental Cost ($)
Core System	PVC	PVC	25%	$1,005	$913	($93)
Manifold System	PVC	PVC	50%	$1,005	$1,478	$473
Demand Recirculation System	PVC	PVC w/ PEX	25%	$1,005	$1,615	$610
Weighted Average			100%	$1,005	$1,371	$366

System Type	Baseline System Cost ($)	Efficient System Cost ($)	Incremental Cost ($)
Two Low-Flow Showerheads	-	-	~$30

Average Estimated Incremental Savings:

It is estimated that the average energy savings for the efficient water distribution system and low-flow showerheads will be approximately 66 kWh per month for homes with electric water heaters and 3 therms per month for homes with gas water heaters.

System Type	Baseline Material	Upgrade Material	Assumed System Weighting	Monthly Electricity Impacts (kWh)			Monthly Gas Impacts (Therms)		
				Baseline System Waste[1]	Efficient System Waste	Efficient System Savings	Baseline System Waste	Efficient System Waste	Efficient System Savings
Core System	PVC	PVC	25%	71	50	21	2.4	1.7	0.7
Manifold System	PVC	PVC	50%	71	44	27	2.4	1.5	0.9
Demand Recirculation System	PVC	PVC w/ PEX	25%	71	21	50	2.4	0.7	1.7
Weighted Average				71	40	31	2.4	1.4	1.1

[1] Energy waste is defined by any energy content, measured in BTU, lost by the hot water; it includes both energy lost while traveling from the water heater to the fixture, as well as energy lost while left in the distribution system in between uses.

ENERGY STAR Qualified Homes 2011
Water Efficiency Measures
Savings & Cost Estimate

System Type	Monthly Electricity Impacts (kWh)			Monthly Gas Impacts (Therms)		
	Baseline DHW Energy	Low-Flow DHW Energy	Low-Flow DHW Savings	Baseline DHW Energy	Low-Flow DHW Energy	Low-Flow DHW Savings
Low-Flow Showerhead	246	211	35	14	12	2

Rationale:

The values for efficient water distribution systems represented in the tables above were calculated using data from a study completed by Oak Ridge National Laboratories (ORNL) for the California Energy Commission. According to the study, cost data was provided to ORNL by a major plumbing contactor. ORNL performed energy engineering calculations on multiple home types; simulating energy loss of running water through piping and standing water after usage. The savings and costs were averaged for the following two homes:

- Three Bedroom, Two Bathroom, One Story, 2010 ft^2
- Four Bedroom, Three Bathroom, Two Story, 2810 ft^2

Two hot water usage profiles were analyzed by ORNL: one with all usages starting from a cold draw; the other with all usages clustered during AM and PM hours, which increases the heat content of the standing water in the piping. The summary data presented above used a weighting factor of 33.3% for the cold draw scenario and 66.6% for the clustered profile. Note that the gas and electric energy waste only accounts for the BTU content lost by hot water during distribution; not losses associated with equipment inefficiencies.

For low-flow showerheads, a nominal cost of $30 for two efficient showerheads was assumed. The costs of showerheads vary widely, from as little as $5 to as high as $80, and are largely driven by features unrelated to efficiency. Therefore, the incremental cost for low-flow showerheads is difficult to precisely estimate, but should be very low. Energy savings were estimated using engineering calculations, assuming an average improvement in efficiency from 2.2 gallons per minute to 1.8 gallons per minute, an approximate reduction of 10 gallons of hot water use per day for showers, a 120°F temperature set-point, and NAECA minimum efficiency water heating equipment.

Supporting Documentation:

The cost and savings cited above for efficient water-distribution systems are derived from the following source:

Wendt, Robert, Baskin, Evelyn, and Durfee, David. “Evaluation of Residential Hot Water Distribution Systems by Numeric Simulation.” Oak Ridge National Laboratory, TN. March 2004.

A sampling of low-flow showerhead efficiency and cost was obtained here:

http://www.metaefficient.com/shower-heads/low-flow-showerheads.html