Cost-Optimized 50% IECC Prescriptive Analysis

Prepared for

National Association of Home Builders

Eight cities (Table 2) representing each of the DOE Climate Zones (Figure 2) were selected to quantify energy savings.

BEopt version 0.9.5.2 was used to perform the optimized energy savings analysis. BEopt was developed by the National Renewable Energy Laboratory in order to calculate energy savings as well as perform cost optimizations. It has a sequential search optimization technique which finds minimum-cost building

perform the energy consumption analysis.

Weighted averaging was applied both within and across climate zones. Within climate zones, wall construction factors for light-framed and mass walls, as well as various foundation types (slab, crawlspaces, and basements), were applied based on the current home construction mix as determined

Affected Climate Zone(s)	Item	Code Requirement	2006 IECC	Proposed 50%	Cost	Unit	Per House	Source	
	Air Sealing	N/R	3 ACH 50	$ 0.41	sq ft floor	$ 955	ASHRAE 1481 RP		1,2,3
	Air Sealing	N/R	2 ACH 50	$ 0.57	sq ft floor	$ 1,337	NAHB RC (2010)		4,5,6,7,8
	Blower Door Testing	N/R	Required	$ 186.04	per house	$ 186	Southface		ALL
	Ceiling Insulation	R-30	R-38	$ 0.28	sq ft attic	$ 501	ASHRAE 1481 RP		3

The simple paybacks in Table 6 are based on an overall average for all changes in the 2012 IECC relative to a 2006 IECC baseline. Consequently, some changes result in shorter paybacks than the average simple payback and some in longer paybacks. This analysis did not calculate the individual payback period for each modification to the 2012 IECC.

As the codes continue to increase in stringency, so does the time it takes for the energy savings investment to pay back. Consequently, if the energy code is developed in a rational manner, the cost effectiveness of each successive code decreases. In Table 7, the simple payback for the optimized 50% S1 0 0 1 72.024 575.26 Tm the 20ized 50%

The energy savings calculation methodology used in this analysis provides detailed incremental construction cost, energy cost savings, and a simple payback for an optimized (minimized cost) 50% energy savings over the 2006 IECC. The national weighted additional cost to construct to the 50% relative to the 2006 IECC is over $14,000 and in excess of $23,000 in Climate Zone 4. The national weighted average annual energy savings from the 2006 IECC baseline to the 50% target is $907 per year.

As energy codes become more stringent, there are diminishing returns on efficiency investments. When using the 2006 as the starting point, the national average simple payback to achieve 50% Savings is just over 16 years; if the starting point is the 2012 IECC, the simple payback is nearly 44 years. This is a strong indicator that energy code efficiency levels are approaching (or have exceeded) their practical maximums.

The 2012 IECC resulted in increased energy savings; however, prescriptive and mandatory requirements were not optimized. Cost-ineffective requirements place cost burdens on the builder that are passed along to the consumer which may never payback. In order to prevent this, the energy code must be flexible in order to allow the builder to cost optimize the energy performance of the house.

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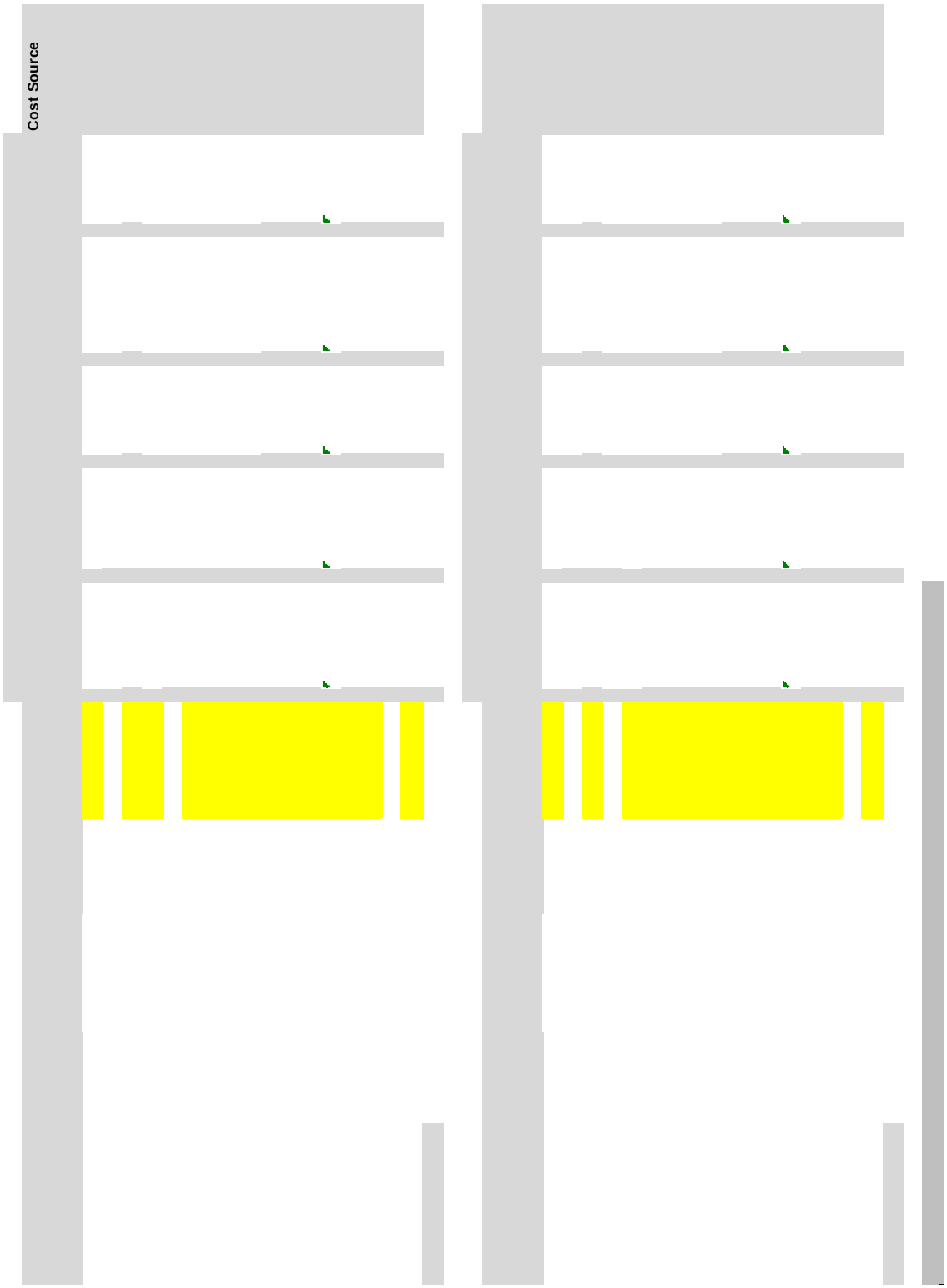
Cost Source
ASHRAE 90.1 Env
$ 1,219
$ -
$ 1,219
$ -
Window
U-Factor
SHGC
Ceilings
Frame Walls
Mass Wall
Floors
1.20
0.40
0.035
0.082
N/A
0.50
0.25
0.035
0.082
N/A

Cost Source
$ 774
Window
U-Factor
0.75
0.35
SHGC
0.40
0.25
Ceilings
sq ft attic
0.035
0.035
Fram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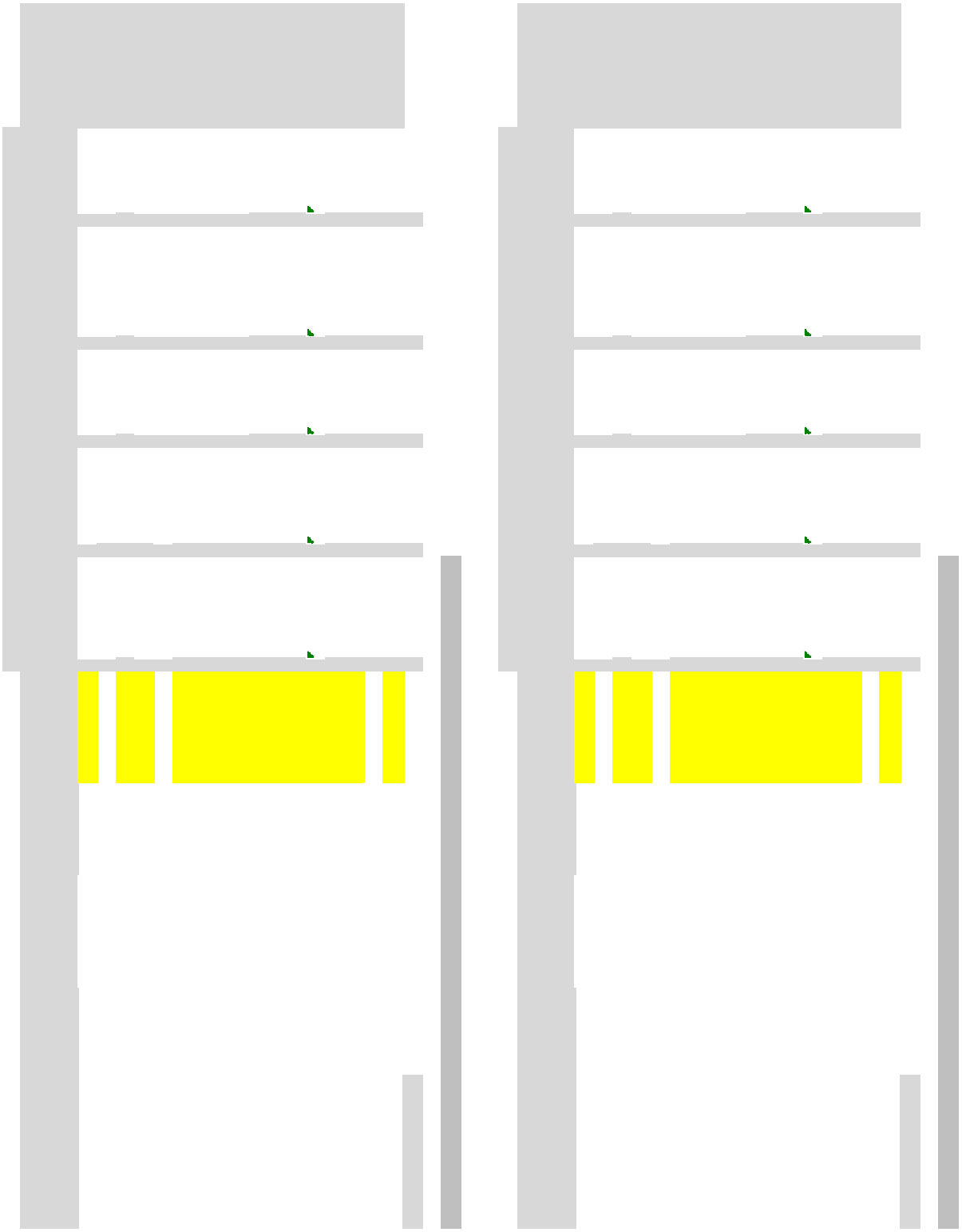
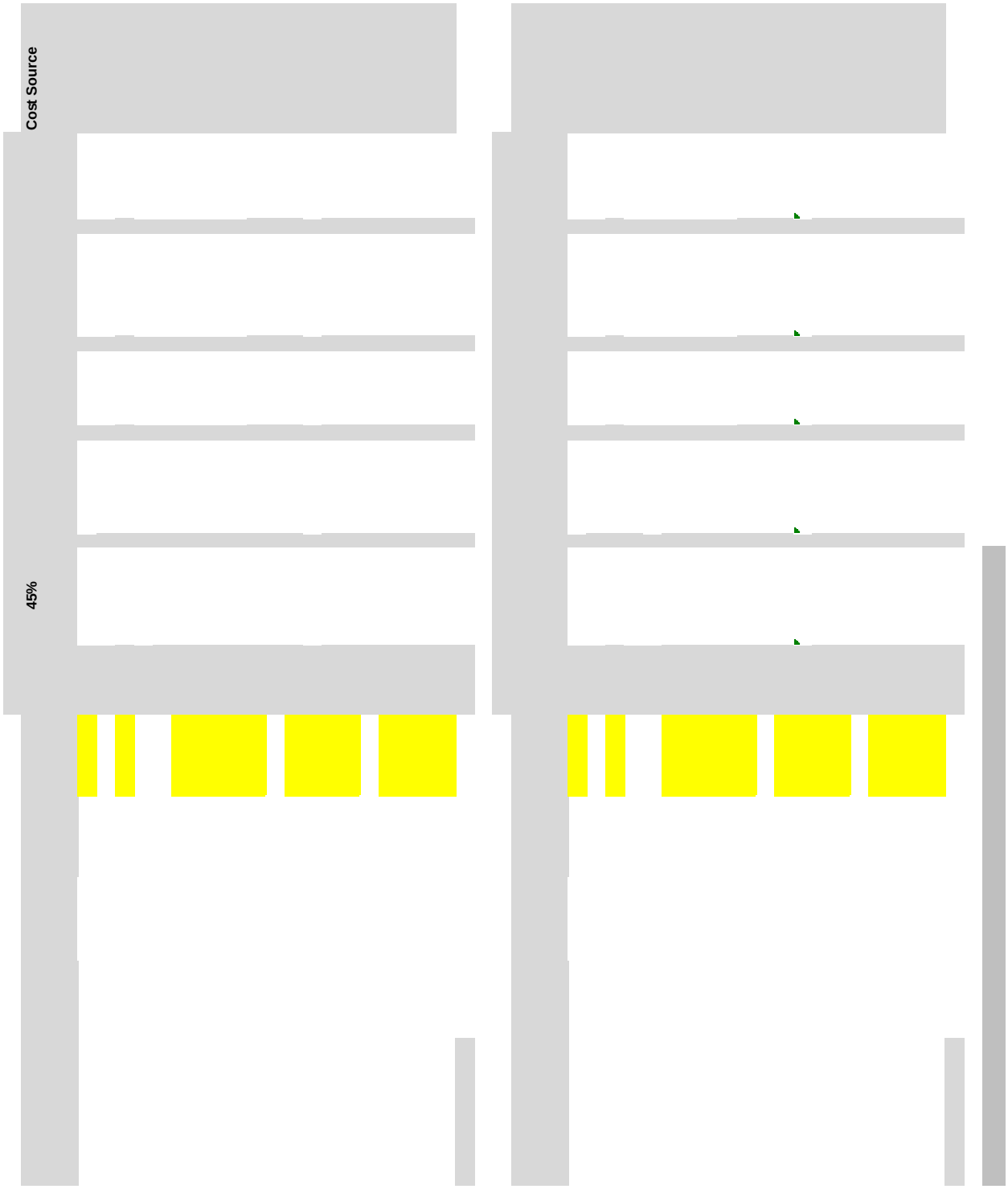


Framed Walls		Cost		Code Requirement			Foundation Distribution 0%	0%	90%	0% Unconditioned Basement	10% Vented Crawlspace	Cost Source
Window	U-Factc	$ 2.00	sq ft window	0.75	0.40				$ 774		$ 774	Paquette (2010)
	SHGC			0.40	0.25							
Ceilings			sq ft attic	0.035	0.035							
Frame Walls				0.082	0.082				$ -			
Mass Wall				N/A	N/A				$ -		$ -	
Floors				0.064	0.064						$ -	ASHRAE 1481 RP
Bsmt Walls				0.360	0.360							
Slab				0	0				$ -			ASHRAE 1481 RP
Crawl Wall				0.477	0.477							
CFL		$ 1.00	% cfl	10%	75%				$ 65		$ 65	Local Survey
Ducts		$ 1,691	per house	15.0%	Inside				$ 1,691		$ 1,691	Building America
Blower Door		$ 186	per house	N/R	Required				$ 186		$ 186	Southface
Air Sealing		$ 0.41	sq ft floor	N/R	3 ACH 50				$ 955		$ 955	ASHRAE 1481 RP
Mechanical Ventilation		$ 430	per house	N/R	Required				$ 430		$ 430	Russell (2005)
Duct Blaster		$ 186	per house	N/R	Required				$ 186		$ 186	Southface
R-3 Plumbing				N/R	R-0							NAHB RC (2010)
Prog Thermostat		$ 28	per house	N/R	Required				$ 28		$ 28	Local Survey
Electric Heat Pump		$ 1,458	per house	13/7.7	15/8.5	70%			$ 1,020		$ 1,020	
Gas Furnace			per house	78	80							
Electric Air Conditione			per house	13.0	15.0							
Incremental Cost									**$ 5,491**		**$ 5,491**	**$ 5,491**

Mass Walls		Cost		Code Requirement			Foundation Distribution 0%	0%	90%	0% Unconditioned Basement	10% Vented Crawlspace	Cost Source
Window	U-Factc			0.75	0.40				$ 774		$ 774	Paquette (2010)
	SHGC			0.40	0.25							
Ceilings			sq ft attic	0.035	0.035				$ -			
Frame Walls				N/A	N/A							
Mass Wall			sq ft wall	R-4	R-4				$ -		$ -	ASHRAE 1481 RP
Floors				0.064	0.064						$ -	ASHRAE 1481 RP
Bsmt Walls				0.360	0.360							
Slab				0	0				$ -			ASHRAE 1481 RP
Crawl Wall				0.477	0.477							
CFL		$ 1.00	% cfl	10% (est)	75%				$ 65		$ 65	Local Survey
Ducts		$ 1,691	per house	15.0%	Inside				$ 1,691		$ 1,691	Building America
Blower Door		$ 186	per house	N/R	Required				$ 186		$ 186	Southface
Air Sealing		$ 0.41	sq ft floor	N/R	3 ACH 50				$ 955		$ 955	ASHRAE 1481 RP
Mechanical Ventilation		$ 430	per house	N/R	Required				$ 430		$ 430	Russell (2005)
Duct Blaster		$ 186	per house	N/R	Required				$ 186		$ 186	Southface
R-3 Plumbing			per house	N/R	R-0							NAHB RC (2010)
Prog Thermostat		$ 28	per house	N/R	Required				$ 28		$ 28	Local Survey
Electric Heat Pump		$ 1,458	per house	13/7.7	15/8.5	70%			$ 1,020		$ 1,020	ASHRAE 1481 RP
Gas Furnace			per house	78	80							ASHRAE 1481 RP
Electric Air Conditione			per house	13.0	15.0							
Incremental Cost									**$ 5,491**		**$ 5,491**	**$ 5,491**

							$ 5,491					

0%
Cost Source RP
Window
Ceilings
Frame Walls
Mass Wall
Floors
Bsmt Walls
Slab
Crawl Wall
CFL
Ducts
Blower Door
Air Sealing
Mechanical Ventilation
Duct Blaster
R-3 Plumbing
Prog Thermostat
Electric Heat Pump
Gas Furnace
Electric Air Conditioner
Paquette (2010)
ASHRAE 1481 RP
Local Survey
Building America
Southface
NAHB RC (2010)
55%


Cost Source
45%

						75%						Cost Source
Window	U-Facto			0.35	0.30		$ 194	$ 194	$ 194	$ 194	$ 194	ASHRAE 90.1 Env
	SHGC			N/R	0.40							
Ceilings				0.026	0.026		$ -	$ -	$ -	$ -	$ -	
Frame Walls		$ 2.31	sq ft of wall	0.060	0.048		$ 5,963	$ 5,963	$ 5,963	$ 5,963	$ 5,963	ASHRAE 1481 RP
Mass Wall				N/A	N/A		$ -	$ -	$ -	$ -	$ -	
Floors		$ 0.56		0.033	0.028					$ 1,001	$ 1,001	
Bsmt Walls		$ 1.18	sq ft base wl	0.059	0.040		$ 1,856					
Slab				10/4	10/4				$ -			
Crawl Wall		$ 1.18	sq ft base wl	0.065	0.040			$ 928				ASHRAE 1481 RP
CFL		$ 1.00	% cfl	10% (base)	100%		$ 90	$ 90	$ 90	$ 90	$ 90	Local Survey
Ducts		$ 902	per house	15% (base)	4cfm/100sf		$ 902	$ 902	$ 902	$ 902	$ 902	Building America
Blower Door		$ 186	per house	N/R	Required		$ 186	$ 186	$ 186	$ 186	$ 186	Southface
Air Sealing		$ 0.57	per house	N/R	2 ACH 50		$ 1,337	$ 1,337	$ 1,337	$ 1,337	$ 1,337	ASHRAE 1481 RP
Mechanical Ventilation		$ 430	sq ft floor	N/R	Required		$ 430	$ 430	$ 430	$ 430	$ 430	Russell (2005)
Duct Blaster		$ 186	per house	N/R	Required		$ 186	$ 186	$ 186	$ 186	$ 186	Southface
R-3 Plumbing			per house	N/R	R-0							NAHB RC (2010)
Prog Thermostat		$ 28	per house	N/R	Required		$ 28	$ 28	$ 28	$ 28	$ 28	Local Survey
Electric Heat Pump		$ 2,470	per house	13/7.7	18/9.5	5%	$ 124	$ 124	$ 124	$ 124	$ 124	ASHRAE 1481 RP
Gas Furnace			per house	78	95.0							
Electric Air Conditioner			per house	13.0	13.0							
Incremental Cost							**$ 13,034**	**$ 12,106**	**$ 11,178**	**$ 12,179**	**$ 12,179**	**$ 12,766**
							$ 12,766					

						75%						Cost Source
Window	U-Facto			0.35	0.30		$ 194	$ 194	$ 194	$ 194	$ 194	ASHRAE 90.1 Env
	SHGC			N/R	0.40							
Ceilings				0.026	0.026		$ -	$ -	$ -			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