Massachusetts Stretch Code Modeling and Cash Flow Analysis[1]
April 2010

780 CMR 120.AA "Appendix 120.AA 'Stretch' Energy Code" was developed to offer cities and towns the option of adopting a more aggressive energy code than the MA baseline energy code (International Energy Conservation Code - IECC 2009). Municipalities who adopt the Stretch Code will meet Criterion 5 of the requirements to be designated as a Green Community. Communities that are designated Green Communities are eligible for grants from an annual pool of up to $10 Million.

Attached are spreadsheets summarizing the energy modeling done on representative homes to illustrate the economic impacts of building a home in MA to the MA Stretch Code. ***The attached analysis illustrates that typical Massachusetts homes can be built to the Stretch Code with a positive cash flow (saving money for the homeowner) in the first year of occupancy.***

Representative homes were modeled that represent the different requirements of the Stretch Code with respect to home size and type of construction:

TYPE OF HOME	HERS RATING REQUIRED	HOME MODELED
< 3000 sf, new construction	70	Small (1,708 sf) Baseline (2,672 sf)
>3000 sf new construction	65	Large (4,462 sf)
< 2000 sf renovation	85	Triple Decker (1700 sf/unit)

All modeling was done using REM/Rate software. The homes were first modeled to meet the IECC 2009 MA baseline energy code as typical new construction or renovation. Annual energy costs of the IECC2009 homes were then determined and used as the baseline for the cash flow analysis. The homes were then modeled to meet the Stretch Code using a least cost analysis to identify typical building envelope and mechanical efficiency upgrades and their estimated costs in MA. Once the HERS targets were reached, the annual energy costs were determined for the Stretch Code homes. The attached spreadsheets show the side-by-side financial comparison of the IECC2009 home and the Stretch Code home with and without implementation of the ENERGY STAR homes program. These results show that a positive cash flow can be obtained in the first year of occupancy in a home built to the Stretch Code under each scenario. The Energy Star homes program is recommended to allow builders to take full advantage of the incentives and support available to them.

It should be noted that these results are representative, but that actual savings and costs will vary for each home. Also, while conservative assumptions were used, and costs used in the analysis are based on average data for the MA and Boston markets, these will vary by location and vendor.

[1] Cash Flow Analysis conducted by Vermont Energy Investment Corporation (VEIC) for DOER.

Massachusetts Stretch Code Improvement - Cash Flow

Baseline Home (2,672 sf)

	IECC 2009 Code	Stretch Code	Stretch Code - with ENERGY STAR[4,5] -
HERS Index Modeled in REM/Rate	**86**	**70**	**70**
Improvement Measures (changes relative to Basecase)	- Unconditioned basement - Floor, R30 - Walls, R21 - Ceiling, R38 G2 - Heating, 80 AFUE - Cooling, 13 SEER - Water Heating, .59 EF - Duct leakage, 8% - Infiltration, 7 ACH50 - Efficient lighting, 50%	- Ceiling, R38 G1 - Heating, 94 AFUE - Water heating, .62 EF - Infiltration, 4 ACH50 - Efficient lighting, 75% - Exhaust Only Ventilation	- Ceiling, R38 G1 - Heating, 94 AFUE - Water heating, .62 EF - Duct leakage, 6% - Infiltration, 5 ACH50 - Efficient lighting, 80% - Exhaust Only Ventilation
Improvement Costs		$ 2,049	$ 2,155
HERS Rater Fee[1]		$ 900	$ 900
HERS Rater reimbursement[2]		-	$ (650)
ENERGY STAR Incentive[3]		-	$ (650)
Total Improvement Costs		$ 2,949	$ 1,755
Mortgage Interest Rate		6%	6%
Loan Term (Years)		30	30
Annual Incremental Mortgage Payment		$ 214	$ 127
Annual Energy Costs[6]	$ 3,970	$ 3,463	$ 3,454
Annual Energy Savings from Baseline		$ 507	$ 516
Annual Cash Flow	**$ -**	**$ 293**	**$ 389**

[1] Estimated Massachusetts ENERGY STAR Homes Program HERS Rater Fee (Range is from $750-$1500, but typically close to $750). Includes cost for conducting Thermal Bypass Inspection

[2] HERS Rater Fees are reimbursed by the Massachusetts ENERGY STAR Homes program by between $650-900 per unit, depending upon the HERS rating achieved.

[3] Massachusetts ENERGY STAR Homes Program may receive a minimum incentive of $650.

[4] ENERGY STAR requirements have been added to the Stretch Code package.

[5] Stretch code homes may qualify for of $1250 where the HERS rating is ~65 or lower

[6] Annual energy costs are based on most recently available fuel costs, from November 2009. Costs for heating are based on natural gas prices, the least expensive heating fuel. With oil, savings would increase.

Massachusetts Stretch Code Improvement - Cash Flow

Large Home (4,462 sf)

	IECC 2009 Code	Stretch Code	Stretch Code - with ENERGY STAR[4,5] -
HERS Index Modeled in REM/Rate	**92**	**65**	**65**
Improvement Measures (changes relative to Basecase)	- Unconditioned basement - Floor, R30 - Walls, R21 - Ceiling, R38 G2 - Heating, 80 AFUE - Cooling, 13 SEER - Water Heating, .59 EF - Duct leakage, 8% - Infiltration, 7 ACH50 - Efficient lighting, 50%	- Ceiling, R60 G1 - Heating, 94 AFUE - Water Heating, .62 EF - Duct Leakage, 6% - Infiltration, 3 ACH50 - Efficient Lighting, 90% - Exhaust Only Ventilation	- Ceiling, R60 G1 - Heating, 94 AFUE - Water Heating, .62 EF - Duct Leakage, 6% - Infiltration, 3 ACH50 - Efficient Lighting, 90% - Exhaust Only Ventilation
Improvement Costs		$ 5,576	$ 5,576
HERS Rater Fee[1]		$ 900	$ 900
HERS Rater reimbursement[2]		-	$ (650)
ENERGY STAR Incentive[3]		-	$ (650)
Total Improvement Costs		$ 6,476	$ 5,176
Mortgage Interest Rate		6%	6%
Loan Term (Years)		30	30
Annual Incremental Mortgage Payment		$ 471	$ 376
Annual Energy Costs[6]	$ 6,510	$ 5,055	$ 5,055
Annual Energy Savings from Baseline		$ 1,455	$ 1,455
Annual Cash Flow	**$ -**	**$ 984**	**$ 1,079**

[1] Estimated Massachusetts ENERGY STAR Homes Program HERS Rater Fee (Range is from $750-$1500, but typically close to $750). Includes cost for conducting Thermal Bypass Inspection

[2] HERS Rater Fees are reimbursed by the Massachusetts ENERGY STAR Homes program by between $650-900 per unit, depending upon the HERS rating achieved.

[3] Massachusetts ENERGY STAR Homes Program may receive a minimum incentive of $650.

[4] ENERGY STAR requirements have been added to the Stretch Code package.

[5] Stretch code homes may qualify for of $1250 where the HERS rating is ~65 or lower

[6] Annual energy costs are based on most recently available fuel costs, from November 2009. Costs for heating are based on natural gas prices, the least expensive heating fuel. With oil, savings would increase.

Massachusetts Stretch Code Improvement - Cash Flow

Small Home (1,708 sf)

	IECC 2009 Code	Stretch Code	Stretch Code - with ENERGY STAR[4,5] -
HERS Index Modeled in REM/Rate	**86**	**70**	**70**
Improvement Measures (changes relative to Basecase)	- Unconditioned basement - Floor, R30 - Walls, R21 - Ceiling, R38 G2 - Heating, 80 AFUE - Cooling, 13 SEER - Water Heating, .59 EF - Duct leakage, 8% - Infiltration, 7 ACH50 - Efficient lighting, 50%	- Ceiling, R60 G1 - Heating, 94 AFUE - Water Heating, .62 EF - Infiltration, 5 ACH50 - Efficient lighting, 75% - Exhaust Only Ventilation	- Ceiling, R60 G1 - Heating, 94 AFUE - Water Heating, .62 EF - Infiltration, 5 ACH50 - Duct leakage, 6% - Efficient lighting, 80% - Exhaust Only Ventilation
Improvement Costs		$ 3,262	$ 3,643
HERS Rater Fee[1]		$ 900	$ 900
HERS Rater reimbursement[2]		-	$ (650)
ENERGY STAR Incentive[3]		-	$ (650)
Total Improvement Costs		$ 4,162	$ 3,243
Mortgage Interest Rate		6%	6%
Loan Term (Years)		30	30
Annual Incremental Mortgage Payment		$ 302	$ 236
Annual Energy Costs[6]	$ 3,754	$ 3,171	$ 3,159
Annual Energy Savings from Baseline		$ 583	$ 595
Annual Cash Flow	**$ -**	**$ 281**	**$ 359**

[1] Estimated Massachusetts ENERGY STAR Homes Program HERS Rater Fee (Range is from $750-$1500, but typically close to $750). Includes cost for conducting Thermal Bypass Inspection

[2] HERS Rater Fees are reimbursed by the Massachusetts ENERGY STAR Homes program by between $650-900 per unit, depending upon the HERS rating achieved.

[3] Massachusetts ENERGY STAR Homes Program may receive a minimum incentive of $650.

[4] ENERGY STAR requirements have been added to the Stretch Code package.

[5] Stretch code homes may qualify for of $1250 where the HERS rating is ~65 or lower

[6] Annual energy costs are based on most recently available fuel costs, from November 2009. Costs for heating are based on natural gas prices, the least expensive heating fuel. With oil, savings would increase.

Massachusetts Stretch Code Improvement - Cash Flow

Cambridge Triple Decker (5,136 sf)

	IECC 2009 Code	Stretch Code
HERS Index Modeled in REM/Rate	**92**	**85**
Improvement Measures (changes relative to Basecase)	- Unconditioned basement - Foundation Walls, R0 - Frame Floor, R30 - Walls, R13 - Ceiling, R38 G2 - Heating, 80 AFUE - Water Heating, .59 EF - Infiltration, 7 ACH50 - Efficient lighting, 50%	- Infiltration, 4.5 ACH50 - Efficient Lighting, 75% - Exhaust Only Ventilation
Improvement Costs		$ 2,202
HERS Rater Fee1		$ 900
Total Improvement Costs		$ 3,102
Mortgage Interest Rate		6%
Loan Term (Years)		30
Annual Incremental Mortgage Payment		$ 225
Annual Energy Costs2	$ 6,828	$ 6,263
Annual Energy Savings from Baseline		$ 565
Annual Cash Flow	**$ -**	**$ 340**

Notes

[1] Estimated Massachusetts ENERGY STAR Homes Program HERS Rater Fee (Range is from $750-$1500, but typically close to $750). Includes cost for conducting Thermal Bypass Inspection

[2] Annual energy costs are based on most recently available fuel costs, from November 2009. Costs for heating are based on natural gas prices, the least expensive heating fuel. With oil, savings would increase.