

# Cold Climate Region: Case Study #4 City of Boulder, SmartRegs Ordinance Single Family Detached, Historic

## Boulder, CO

Program	SmartRegs Ordinance
Location:	Boulder, Colorado
Building Type:	Single Family Detached
Building Size:	2252 ft <sup>2</sup>
Foundation:	Conditioned Basement
Configuration:	3 bedrooms, 2 baths
SWA Contact:	Lois Arena

This single family detached rental home is located in Boulder's highly desirable Mapleton Hill neighborhood. It is a 3 bedroom, 2 bathroom two-story house approximately 2252 ft<sup>2</sup> built over a conditioned, unfinished basement/crawlspace foundation. The home was built in 1911 and holds a historic designation, which means little can be done to the outside of the building without written approval from the City.

The property owner for this rental became involved in the SmartRegs process early on for a few reasons. First, she is a real estate broker who believes that complying with the latest requirements is smart business decision, because buyers will factor this in to their purchasing decision. Also, she argues that since landlords must comply with these regulations anyway, she might as well make any necessary improvements sooner rather than later. Besides this, the owner sees herself as environmentally conscious and believes that improving the energy efficiency of her properties is the right thing to do.

Efficiency levels of the building shell—walls, attic and foundation—were consistent with its year of construction (see table at right), but the heating and cooling systems have been upgraded with high efficiency equipment and the ductwork, where accessible, has been sealed. At the time of the inspection for this case study, the owner was employing a carpenter, who specializes in historic properties, to perform extensive air sealing for her.

This property was between rentals when this case study was conducted because of the extent of the improvements being done, but like all the other landlords interviewed, this owner indicated that she has never had any problems renting her properties in Boulder.



***This historic home scored 87 points on the SmartRegs checklist. The property owner must make some energy efficiency improvements to comply with Boulder's new ordinance.***

### Energy Efficient Features

Attic:	R-11 rock wool
Walls:	Uninsulated
Windows:	Single pane wood
Foundation:	Conditioned basement/crawlspace R-0
Heating:	Forced air, natural gas, 90+ AFUE in conditioned basement
Cooling:	SEER 15
Ductwork:	In conditioned basement
Hot Water:	Atmospheric, natural gas, conditioned space, 0.58 EF

Air Leakage: 16.6 ACH@50 pascals, 0.90 ACHn

### Additional SmartRegs Features

None

**SmartRegs Checklist Score\*: 87 points\*\***

(The final score must be  $\geq 100$ )

**HERS Index: 155**

\*100 points on the SmartRegs checklist should approximately equate to a HERS index of 120.

\*\*Adjustments were made to auditor's original score of 75. See Compliance section on page 2 for explanation of adjustments.

## Boulder, CO

This property owner, like many others, opted to use the prescriptive method of compliance and have the auditor fill out a checklist rather than perform energy modeling to determine if the property was in compliance. A SmartRegs score of 100 is meant to approximately equate to a HERS Index of 120. It is anticipated that some homes will exceed and some will be under this threshold.

Although the auditor originally calculated an as-is score of 75 on the SmartRegs checklist, a few corrections had to be made based on information gained during this case study. The corrections are as follows:

- -2 points, water heater was less efficient than originally assumed;
- -1 point, the refrigerator was less efficient than originally assumed;
- -5 points, the % of basement wall was too high;
- +6 points, cooling was not given credit originally
- +14 points, ducts were not test during initial audit but were tested during case study inspection

The total of these adjustments is +12 points resulting in a SmartRegs score of 87 (HERS Index of 155 points). Because the minimum allowable score is 100 points, the owner will have to improve the property by 2019 in order to maintain the rental permit required by the City of Boulder.

Insulation improvements to this home would be difficult in most areas, including the attic. There is no access to the knee wall areas on the 2nd floor, so insulating the sloped sections of the attic and the knee walls would not be possible without making several new access hatches. Another problem with insulating the attic is the presence of the knob and tube wiring, which should be replaced with knob wiring before any additional insulation is installed.

Because this home is historic and has brick walls on the 1st floor, improvements to the exterior walls from the outside are not usually a viable option. In addition to this, the interior finish is lath and plaster which makes insulating walls

## Facts about SmartRegs

2 Compliance Paths: Prescriptive or Performance

- Prescriptive:  $\geq 100$  points on Checklist
- Performance: HERS Index  $\leq 120$



**Attic is only insulated to R-10 and contains knob and tube wiring.**

from the inside extremely difficult, messy and destructive.

Insulating the basement/crawl is not even a very viable option due to the amount of personal property currently being stored there.

The easiest upgrade option to bring this home into compliance would be to add storm windows to all the windows in the home. Although expensive, these would have a significant impact on the energy use of the home and on the comfort of the occupants. On historic properties, adding storm windows gains the owner 13 points. This would bring the SmartRegs score up to 100 for this property and results in a HERS Index of 144 points.

There could be several reasons why the improved case does not achieve a HERS Index of 120, but scores 100 or more points on the SmartRegs checklist. For this home, it is anticipated that this discrepancy comes from the fact that the ceiling is getting full credit for being insulated to R-19, when it is really a combination of about R-10 on the flat sections and R-0 on the sloped (program administrators intend to correct this in the future). Also, storm windows on historic homes receive more than twice the points as window with a similar efficiency on a non-historic home. This is to ease some of the burden on the owners, because improving historic properties is usually so difficult and costly. If these two components are upgraded to the actual levels on the checklist for which they are being given points—R-19 attic and U-0.35 windows—the resulting HERS Index is 125, very close to the intended threshold.

## Boulder, CO

SmartRegs requirements were adopted to meet the city's sustainability objectives including environmental health, economic vitality and social equity. According to current statistics, rental properties comprise approximately 50 percent of Boulder's housing stock<sup>1</sup>. Therefore, by requiring property owners to upgrade rental properties, the SmartRegs program aids in advancing Boulder's community sustainability objectives, and will hopefully result in lower energy bills for tenants.

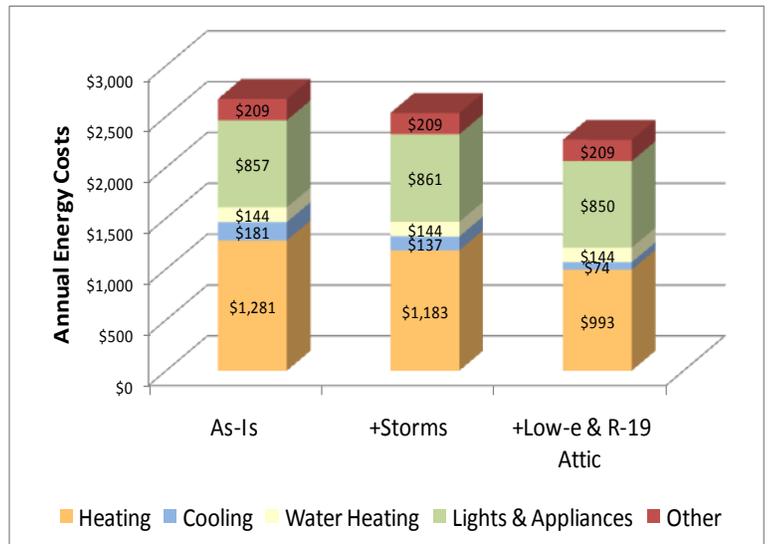
Predicted monthly utility bills for this property as it existed at the time of the initial inspection are displayed in the graph to the right. REM/Rate predicts an annual utility bill of \$2,672: about 50%, \$1,281, is attributed to heating.

Installing storm windows (HERS index of 144) - results in predicted annual utility bill savings for the occupants of about \$138 per year.

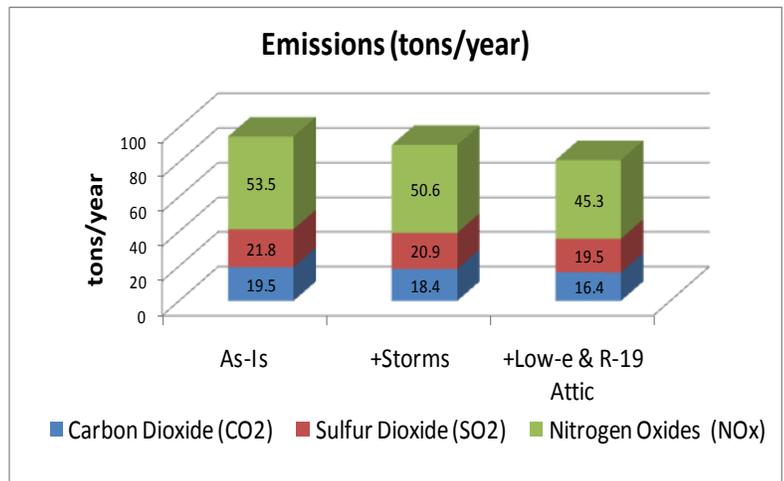
Predicted emissions reductions range from 4 to 7%. Total emissions are displayed in the graph to the right.

If efficiencies of the windows and attic were actually brought to the levels for which they are being (or would be, in the case of the windows) given credit on the SmartRegs checklist, annual savings increase to about \$400 per year, and emissions reductions range from 11 to 16% over the levels currently predicted for this property.

To better analyze programs like SmartRegs, comparisons to actual utility bills are critical. Unfortunately, obtaining utility bills from major providers has been and remains incredibly difficult, even with signed consent forms from homeowners or renters. While this is not necessarily a barrier to program implementation, it is a huge barrier to improving these programs and ensuring that the upgrades being recommended are effective from an energy reduction and a cost-effectiveness standpoint. Removing this barrier is essential in meeting long term program goals.



Predicted utility bills from REM/Rate.



Predicted NO<sub>x</sub>, SO<sub>2</sub>, and CO<sub>2</sub> emissions from REM/Rate.

<sup>1</sup>2011 SmartRegs Handbook, City of Boulder

### Boulder, CO

The property owner was interviewed to determine her feelings and concerns about Boulder's new SmartRegs ordinance. A summary of her opinions and suggestions for improvements are below.

**Q: Why did you decide to participate now and not wait till later in the process?**

A: The owner sees herself as a perfectionist and is information driven. She is also a real estate broker and feels compliance will affect property value because buyers will look for it. She argues that landlords must comply with these new regulations, so they might as well do it sooner rather than later. She also believes improving the efficiency of her properties is the right thing to do for the environment.

**Q: How long has the owner owned this property?**

A: 8 years. The owner bought this property as a rental, but is currently living in it while remodeling.

**Q: Are you educating the occupants about what and why renovations are taking place and how it will benefit them?**

A: Yes, the owner tries to raise the consciousness of the renters. She has 13 other rentals in all, some out of state.

**Q: What's the vacancy rate for your property?**

A: There are no problems with vacancy in Boulder.

**Q: What is your normal maintenance routine – i.e., every few months, once a year, on occupant turn over?**

A: This landlord provides occupants with enough furnace filters for a monthly change for the entire year. On occupant turnover she cleans, repairs things, reseals baths, and replaces all light bulbs.

**Q: What would you like other property owners to know?**

A: This owner believes that information is power; that if you don't know what is wrong or what is required, you can't fix it. She feels that other property owners have nothing to lose by having the inspection, since they have to comply anyway. The landlord feels it's the right thing to do, otherwise, you're wasting resources.

*Steven Winter Associates, Inc. is the lead for the Department of Energy's Building America team called the Consortium for Advanced Residential Buildings (CARB).*

*CARB would like to thank Populus, LLC, a sustainable design consulting firm and the program administrator for the City of Boulder's SmartRegs program, for their expertise, time and assistance in creating these case studies.*