

RCI-6. Incentives and Policies for Improving Building Efficiency, Including Building Energy Codes

Policy Description

Almost half of all U.S. GHG emissions annually are associated with the operation of residential, commercial, and industrial buildings along with the embodied energy of building materials.³⁷ Improving the energy efficiency of state and/or local buildings—for example, by strengthening building energy codes—will have a considerable immediate and ongoing impact on reducing building-sector GHG emissions.

South Carolina law requires statewide use of the most up-to-date building codes, as defined by the International Energy Conservation Code (IECC). The IECC specifies minimum energy efficiency requirements for new buildings or for existing buildings undergoing a major renovation. South Carolina’s local governments adopt and enforce the building codes.

Manufactured housing is exempt from South Carolina’s building energy code. Instead, manufactured homes are subject to standards established by the U.S. Department of Housing and Urban Development (HUD). A significant percentage of South Carolinians reside in manufactured housing.

To ensure that South Carolina’s buildings, including manufactured homes, maximize the cost-effective potential for energy efficiency and minimize GHG emissions, the following policy prescriptions are recommended:

- Improve statewide enforcement of both existing and new building codes at all levels.
- As appropriate, modify codes to remove obstacles to renewable energy use, daylighting, and nonconventional energy-efficient building materials in buildings where applicable.
- Update South Carolina energy codes regularly. This update should be timed to coincide with release of national model codes every 3 years. Local adoption of new statewide codes should occur within 6 months of statewide code adoption. (RCI-8, including education of building inspectors and other building professionals, is a supporting policy.)
- Task the South Carolina Building Codes Council with considering advanced codes (i.e., beyond IECC) as appropriate for the state (e.g., California Title 24).³⁸
- Require manufactured housing and manufactured nonresidential buildings used in South Carolina to meet ENERGY STAR certification standards after 2015.

³⁷ U.S. DOE, EIA, U.S. Energy Consumption by Sector. Available at: http://www.architecture2030.org/building_sector/index.html.

³⁸ Note that research would be required to identify which portions of the California Title 24 codes are most applicable and appropriate for South Carolina.

- Provide state support for low-interest financing for the incremental cost of ENERGY STAR-certified manufactured housing.
- Lobby for more stringent codes for manufactured housing at the federal level.

Policy Design

Goals:

- 100% of South Carolina’s local governments adopt and fully enforce the 2006 IECC in 2009.
- 100% of South Carolina’s local governments adopt and fully enforce the 2012 IECC in 2015.
- ENERGY STAR-labeled manufactured homes achieve 25% market penetration for new manufactured homes by 2010 and 75% by 2020.

Timing: As noted above.

Parties Involved: As noted above.

Implementation Mechanisms

- *Legislative Changes To Allow Adoption and Enforcement of Energy Efficient Building Codes*—Building codes and energy codes are adopted by the South Carolina Building Codes Council (SCBCC) for all municipalities. The 2006 editions of the International Residential Code (IRC), which covers one and two family dwellings and multiple single-family dwellings, and the International Building Code (IBC), which covers other residential construction (e.g. high rise condominiums, mixed use developments), will take effect in South Carolina on July 1, 2008. However, conflicts with state law have severely weakened the effectiveness of the building codes adopted by the SCBCC. Chapter 11 of the 2006 IRC, which includes residential energy efficiency requirements, has been superseded by an outdated 1976 state law.³⁹ The 1976 legislation prescribed specific building envelope requirements for one- and two-family dwellings (indicated in red text, below), which would impede progress toward advanced energy efficiency measures as described in RCI-6. These specific requirements also put excessive demands on building code officials, who currently must know and enforce codes and standards from two different sources. The legislature can greatly facilitate adoption and enforcement of improved energy codes by striking Part C with its sub-parts from section 6-9-50 of the South Carolina Code of Laws:

SECTION 6-9-50. Mandatory adoption of certain nationally recognized codes and standards; adoption by reference; residential buildings; accessibility of referenced code; three-story homes.

(A) The council shall adopt by reference and amend only the latest editions of the following nationally recognized codes and the standards referenced in those codes for regulation of construction within this State: building, residential, gas, plumbing, mechanical, fire, and energy codes as promulgated, published, or made available by the International Code Council, Inc. and the National Electrical Code as published by the National Fire Protection Association. The appendices of the codes provided in this section may be adopted as needed, but the specific appendix or appendices must be referenced by name or letter designation at the time of adoption. However, the provisions of the codes referenced in this section which concern the qualification, removal, dismissal, duties, responsibilities of, and administrative procedures for all building officials, deputy

³⁹ South Carolina Code of Laws, Title 6, Chapter 9, enacted 1976.

building officials, chief inspectors, other inspectors, and assistants do not apply unless they have been adopted by the municipal or county governing body.

(B) The governing body of a county may not enforce that portion of a nationally recognized fire prevention code it has adopted which may regulate outdoor burning for forestry, wildlife, and agricultural purposes as regulated by the South Carolina Forestry Commission.

(C) A residential building is considered in compliance with the Building Envelope Requirements of the Energy Code if:

(1) it is built in compliance with prescriptive standards issued by the South Carolina Residential Builders Commission, in consultation with the State Energy Office, based on computer models of the Energy Code including, but not limited to, options developed by Pacific Northwest National Laboratories, or other nationally recognized laboratories which use the standards developed by Pacific Northwest National Laboratories, for South Carolina's climatic zones, or

(2) if double pane or single pane with storm windows are used for window glass and in the case of ceilings, exterior walls, floors with crawl space, and heating and air conditioning duct work, the determination of the minimum thermal resistance ratings (R-value) is:

(a) R-30 for ceilings, except for ceiling/roof combinations, which must be at least R-19;

(b) R-13 for exterior walls;

(c) R-19 for floors with crawl space;

(d) R-6, or the installed equivalent, for heating and air conditioning duct work not located in conditioned space.

(D) All referenced codes adopted by the council shall be accessible at no cost to the public through the Department of Labor, Licensing and Regulation's Internet web page as a "read only" document.

(E) Notwithstanding any provision of the referenced codes adopted by the council, a home with three floors of living space constructed on a raised foundation which is not used as living space is considered a three-story building for the purposes of issuing a building permit to a person licensed under Title 40, Chapters 11 and 59. Any person authorized in South Carolina to design and construct buildings up to three stories is authorized to design and construct buildings described by this section.

- *High-Performance Building Codes for Energy and Efficiency*—These codes specify minimum energy efficiency requirements for new buildings or for existing buildings undergoing a major renovation and/or additions. The minimums specified should be updated regularly—e.g., every 3 years.
- *Review of Existing Building and Trade Codes*—The state should undertake a comprehensive review of existing state and local building and trade codes to determine where increased energy efficiency can be achieved.
- *Education, Training, Certification and Technical Assistance*—Education, training and certification is expected to be a major component of improving building and trade codes. It will be necessary to develop enhanced state-mandated training, education, and certification for code officials, builders, and tradesmen. Education and outreach are important to help consumers and constituents understand the benefits of and cost savings from implementing these programs. Funding should be set aside for training and educating building inspectors.

- *Statewide Code and Inspections Program*—Understanding the importance of local government adoption and control over code enforcement, a minimum standard should be established statewide for related codes, permitting, and inspection.
- *Utility Involvement and Assistance*—The state should consider using utility resources to help implement energy codes. This can include energy audits, review and promotion of energy codes, interconnection rules, and tariffs and connection charges that encourage the construction and rehabilitation of buildings that incorporate energy efficiency.
- *Permitting and Fee Advantages*—To encourage building retrofit, the state should provide programs that speed the permit approval process and reduce the permit and impact fees related to construction. Advantages could include reduced building permit fees, water and sewer fees, and impact fees.
- *Rewards Programs*—The state should develop systems and programs that reward “beyond code” energy efficiency and emission reduction improvements, including “green mortgages,” additional floor area ratio and/or zoning density for construction that meets or exceeds energy efficiency programs, or tax incentives. It should also work with financial institutions to develop loan tools for these programs, including nontraditional, off-grid, low- and carbon-neutral energy sources.
- *Compliance Flexibility*—Codes could allow permittees to utilize a combination of increased energy efficiency, switching to low- and no-carbon-based fuels for previously carbon-based end uses, off-site purchases of grid-supplied “green power,” and/or installing on-site, off-grid, power-generating equipment.
- *Incentives To Promote ENERGY STAR-Manufactured Homes*—The Manufactured Housing Research Alliance is currently using direct incentives for home retailers to promote ENERGY STAR-manufactured homes.⁴⁰ The incentives are \$400 for gas-heated homes and \$700–\$750 for electrically heated homes. The higher rebate for electrically heated homes is to help cover part of the incremental cost of the heat pump that is required for these homes. The Alliance has not administered programs that offer low-interest financing.

Related Policies/Programs in Place

Senator Jim Ritchie (R-Spartanburg) introduced a bill in 2007 (now passed) that would provide tax incentives and faster permitting for private developers to meet the U.S. Green Building Council’s Leadership in Energy and Environmental Design™ (LEED) silver standard.

A partnership of the South Carolina Energy Office, local homebuilder associations, and Southface Energy Institute is piloting an EarthCraft house program for Charleston and Greenville through which over 100 EarthCraft homes have been built.

International Code Council and IECC standards apply in South Carolina.

⁴⁰ Per an e-mail to Jennifer Kallay from Gwynne Koch, Manufactured Housing Research Alliance, dated Jan. 4, 2008.

Manufactured homes that meet Santee Cooper’s Good Cents Manufactured Homes criteria qualify for Santee Cooper’s Good Cents rate.⁴¹

Type(s) of GHG Reductions

Reduction in GHG emissions (largely CO₂) from avoided electricity production or on-site fuel combustion.

Estimated GHG Reductions and Net Costs or Cost Savings

This analysis consists of two components: energy savings from new code adoption and enforcement, and energy savings from increased penetration of ENERGY STAR-manufactured homes. As a result, the data sources, quantification methods, and key assumptions will be specified separately for each component.

Table 11. Estimated GHG reductions and net costs or cost savings from RCI-6

RCI-6 Components	GHG Reductions (MMtCO ₂ e)			Gross Costs (Million \$)	Gross Benefits (Million \$)	Net Present Value 2009–2020 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)
	2012	2020	Total 2009–2020				
RCI-6 Total	1.4	6.3	34.9	\$1,362	–\$1,765	–\$403	–\$11.6
Residential Building Codes	1.3	5.3	30.1	\$1,267	–\$1,528	–\$261	–\$8.7
Commercial Building Codes	0.1	0.9	4.3	\$86	–\$217	–\$131	–\$30.3
Residential ENERGY STAR-Manufactured Homes	0.0	0.1	0.4	\$9	–\$20	–\$11	–\$27.5

Data Sources:

For IECC 2006 Adoption and Enforcement:

Benefits:

- Building Codes Assistance Project (BCAP), “Code Status Detail,” available at: http://www.bcap-energy.org/code_status.php?STATE_AB=SC.
- U.S. DOE, Office of Energy Efficiency and Renewable Energy, “South Carolina Additional State Info,” available at: http://www.energycodes.gov/implement/state_codes/state_stat_more.php?state_AB=SC.
- R.G. Lucas (January 2007), *Analysis of Energy Saving Impacts of New Residential Energy Codes for the Gulf Coast*, PNNL 16265, Richland, WA: U.S. DOE, Pacific Northwest National Laboratory. Accessed January 2, 2008, at: <http://www.energycodes.gov/pdf/pnnl16265.pdf>.

⁴¹ More information can be found at: <https://www.santeecooper.com/portal/page/portal/SanteeCooper/MyHome/ResidentialGoodCents/GoodCentsManufacturedHomes>.

- M.A. Halverson, K. Gowri, and E.E. Richman (December 2006), "Analysis of Energy Saving Impacts of New Commercial Energy Codes for the Gulf Coast," Pacific Northwest National Laboratory. Accessed January 6, 2008, at: <http://www.energycodes.gov/pdf/pnnl16282.pdf>.
- BCAP, personal communications with Aleisha Khan with Jennifer Kallay in January, 2008.

Costs:

- Greg Katz and Jon Braman. Greening Buildings and Communities: Costs and Benefits. Draft Findings on the Cost Premium, Energy and Water Savings by LEED Level. 2008.
- ICC Code Website. Building Valuation Data. Accessed March 13 , 2008, at: <http://www.iccsafe.org/cs/techservices/>.

For Increased Penetration of ENERGY STAR-Manufactured Homes:

Benefits:

- U.S. Census Bureau. *2006 American Community Survey: South Carolina Selected Housing Characteristics*. Accessed December 17, 2007, at: http://factfinder.census.gov/servlet/ADPTable?_bm=y&-geo_id=04000US45&-qr_name=ACS_2006_EST_G00_DP4&-ds_name=ACS_2006_EST_G00_&-lang=en&-sse=on.
- Manufactured Housing Research Alliance (January 2006), *Factory Built Housing Roadmap (Including Recommendations for Energy Research)*, U.S. Department of Housing and Urban Development. Accessed December 19, 2007 at: <http://www.pathnet.org/sp.asp?id=18383>.
- Institute for Building Technology and Safety, "Manufactured Home Shipments by State (1990–2006)". Accessed December 27, 2007 at: <http://www.manufacturedhousing.org/admin/template/subbrochures/390temp.pdf>
- Forefront Economics, Inc., H. Gil Peach & Associates LLC, and PA Consulting Group (July 24, 2007), *Duke Energy Carolinas DSM Action Plan: South Carolina Draft Report*. (Not available online.)
- Support via e-mails from and conversations with Gwynne Koch at the Manufactured Housing Research Alliance with Jennifer Kallay in January 2008.

Costs:

- U.S. Census Bureau, "Average Sales Price of New Manufactured Homes Placed for Residential Use: All Homes, Single-Section & Double-Section Homes (1990–2001, in dollars)." Accessed December 27, 2007, at: <http://www.manufacturedhousing.org/admin/template/subbrochures/394temp.pdf>.
- Forefront Economics, Inc., H. Gil Peach & Associates LLC, and PA Consulting Group (July 24, 2007), *Duke Energy Carolinas DSM Action Plan: South Carolina Draft Report*. (Not available online.)
- Support via e-mails from and conversations with Gwynne Koch, Manufactured Housing Research Alliance.

Quantification Methods:

For IECC 2006 Adoption and Enforcement:

Benefits:

- Compliance rates associated with adoption and full enforcement were estimated. Then, the percentage of new and renovated homes and buildings to be built to the 2006 IECC was determined, along with the incremental energy savings. After the energy savings were broken out by fuel type, the GHG emission reductions were calculated using emission factors for each fuel type. The avoided costs by fuel type were also calculated.

Costs:

- Incremental construction cost percentages were multiplied by the average cost of South Carolina homes and office buildings to determine the incremental cost per building for different levels of energy savings associated with different programs.

For Increased Penetration of ENERGY STAR-Manufactured Homes:

Benefits:

- A ramp-in scenario was developed based on the market penetration goals and the current penetration of ENERGY STAR-manufactured homes in the state. Then, the number of new manufactured homes to be built to the ENERGY STAR standard instead of the federal HUD standard was determined, along with the incremental energy savings by these homes. After the energy savings were broken out by fuel type, the GHG emission reductions were calculated using emission factors for each fuel type. The avoided costs by fuel type were also calculated.

Costs:

- The incremental cost of an ENERGY STAR-manufactured home as compared to a manufactured home built to the federal HUD standard was multiplied by the total number of federal HUD homes that were replaced by ENERGY STAR-manufactured homes to calculate the total incremental cost of this policy.

Key Assumptions:

For Building Code Adoption and Enforcement:

- For the residential sector, the state standard overrides the need for builders to follow the 2003 IECC, even though it is in place. For the commercial sector, the 2003 IECC is in force.
- This analysis assumes that improvements are incremental to a scenario where the status quo persists. The benefits and costs for new homes are derived from the fact that these homes are built to future building codes that are more stringent than current codes. The benefits and costs for renovated homes are derived in the same way; instead of being renovated to current codes, these homes will be renovated to more stringent codes.
- A new building is defined as any building that is built between 2009 and 2020. A renovated building is defined as any building that undergoes major renovations between 2009 and 2020.

Benefits:

- In 2009 (with adoption and partial enforcement), 60% of new and renovated buildings and homes achieve 2006 IECC and 40% continue to be built to 2003 IECC. In 2010 (with adoption and full enforcement), 80% of new and renovated buildings and homes achieve 2006 IECC. In 2015, we assumed that code enforcement practices are in place and 80% of new and renovated buildings and home can achieve the 2012 IECC with the adoption of the code. Table 12 presents the key assumptions for the potential benefits from this policy option.

Table 12. Key assumptions for benefits from RCI-6

Assumption	Residential Sector	Commercial Sector	Notes
Number of New Homes/Buildings	663,719	14,274	Scaled from regional data using population
Ratio of New vs. Renovated Homes/Buildings	1.00	1.00	
Average Energy Use	0.0566 BBtu/home/yr	0.00008 BBtu/sq. ft./yr	Calculation of energy use divided by the projected number of homes/buildings
Average Square Footage per Building	1,700	11,829	Calculation of projected square footage of buildings divided by the projected number of buildings
Cumulative Energy Savings 2006 IECC 2012 IECC	vs. the 1976 Standard 32% 67%	vs. the 2003 IECC 8% 38%	From Aleisha Khan of BCAP
Proportion of Energy Savings by Fuel Type	76% Electricity 24% Natural Gas	75% Electricity 25% Natural Gas	Based on the breakout in the Inventory & Forecast
Emissions Factors, T&D Electricity Losses, Avoided Energy Costs (Delivered)	Same assumptions as used for RCI-1 and RCI-2		

Costs: Table 13 presents the key assumptions for the potential costs of this policy option.

Table 13. Key assumptions for costs of RCI-6

Assumption	Residential Sector	Commercial Sector	Notes
Real Discount Rate	5%		
Capital Recovery Factor for Levelization	6.20% Interest Rate: 5.0% Period: 30 yrs	6.52% Interest Rate: 5.5% Period: 30 yrs	Calculated assumption
Average Construction Cost of a Home/Building	\$187,425	\$1,546,610	Based on national estimates from the International Code Council (ICC)

Assumption	Residential Sector	Commercial Sector	Notes
Incremental Costs From Building Code Improvements	vs. the 1976 Standard	vs. the 2003 IECC	Based on incremental costs associated with LEED levels that achieve similar energy savings
2006 IECC	2%	0.5%	
2012 IECC	4%	2%	

For Increased Penetration of ENERGY STAR-Manufactured Homes:

Benefits:

- *Current Market Penetration in South Carolina: 0.19%.*
- *Market Penetration Ramp-In: See Table 14.*

Table 14. Market penetration ramp-in for RCI-6

Year	Target
2009	10%
2010	25%
2011	30%
2012	35%
2013	40%
2014	45%
2015	50%
2016	55%
2017	60%
2018	65%
2019	70%
2020	75%

- *Energy Use of Manufactured Homes Built to Federal HUD Standards: 0.079 billion Btu/home/yr.*
- *Energy Savings for an ENERGY STAR-Manufactured Home: 35%.*
- *Number of Manufactured Homes in South Carolina in 2006: 378,366.*
- *Projected Annual Growth in Manufactured Home Sales: 2,700/yr.*
- *Proportion of Energy Use by Fuel Type in Manufactured Homes:*
 - Electricity: 76%.
 - Natural Gas: 15%.
 - LPG: 9% (not modeled).
- *Avoided Energy Costs by Fuel Type:*
 - Electricity, Natural Gas: Same assumptions as used for RCI-1 and RCI-2.
- *Emissions Factors by Fuel Type:*

- Electricity, Natural Gas: Same assumptions as used for RCI-1 and RCI-2.

Costs:

- *Real Discount Rate, T&D Electricity Losses*: Same assumptions as used for RCI-1 and RCI-2.
- *Capital Recovery Factor for Levelization*: 6.76%.
 - Interest Rate: 5%.
 - Period: 25 yrs.
- *Average Sales Price of a Manufactured Home in South Carolina*: \$54,300/home (2004\$).
- *Incremental Cost for an ENERGY STAR-Manufactured Home*: \$2,600 /home (2006\$).

Key Uncertainties

Assumptions for which little supporting data were available include:

- The number of renovated homes and buildings;
- The building code compliance rate under partial and full enforcement; and
- The cost of building code implementation.

Additionally, the cost of new construction is based on national estimates. Region-specific estimates are not available but may be either higher or lower than these costs.

During the implementation stage, there will be a need to define the threshold that would trigger the need for a building code permit for new buildings, existing buildings undergoing major renovations and existing buildings undergoing minor renovations.

Avoided costs of electricity may not reflect the full costs of new generation planned in South Carolina. For example, nuclear power plant busbar costs are around or above \$100/MWh, well above the avoided cost of \$55.75/MWh assumed in this analysis. In addition, DSM has been shown to lower the wholesale price of electricity during some periods.^{42,43} Both of these factors may increase the value of DSM to the state.

Additional Benefits and Costs

- Resource conservation, including water: lower water demand leads to lower costs and reduced energy use for water production.
- Indoor comfort and air quality improvements, with related improvements in health and productivity.

⁴² Rick Hornby, Dr. Carl V. Swanson, Michael Drunsic, Dr. David E. White, Paul Chernick, Bruce Biewald, and Jennifer Kallay (January 2008). *Avoided Energy Supply Costs in New England: 2007 Final Report*. Prepared for Avoided-Energy-Supply-Component (AESC) Study Group. Available at: <http://www.synapse-energy.com/Downloads/SynapseReport.2007-08.AESC.Avoided-Energy-Supply-Costs-2007.07-019.pdf>.

⁴³ RLW Analytics, Neenan Associates (December 2005). *An Evaluation of the Performance of the Demand Response Programs Implemented by ISO-NE in 2005. Annual Demand Response Program Evaluation submitted to FERC*. Available at: <http://www.iso-ne.com/regulatory/ferc/filings/2005/dec/er02-2330-12-30-05.pdf>

- Savings to consumers and businesses on energy bills, which can have macroeconomic benefits. Benefits to low-income households from reduced utility costs.
- Electricity system benefits: reduced peak demand, reduced capital and operating costs, improved utilization and performance of electricity system
- Reduced pollutants from emissions, improved health from fewer pollutants and particulates, and reduced water use for cooling.
- Employment expansion and economic development.
- Reduced dependence on imported fuel sources.
- Reduced energy price increases and volatility.

Feasibility Issues

Reaching 25% market penetration for ENERGY STAR-manufactured homes over the course of a year may prove challenging, considering that there is currently little market penetration for these homes in the state.

Gwynne Koch at the Manufactured Housing Research Alliance stated: “Our target market penetration for ENERGY STAR-manufactured homes in the areas of the country where we are currently administering utility-sponsored rebates depends on the amount and type of incentive being provided. However, these targets are currently less than 25% of new home shipments. As we discussed, a target of 25%–75% penetration within just a few years is an optimistic, albeit likely unrealistic, target.”

Also, Ms. Koch noted: “There are no facilities/plants in South Carolina that are certified and that are producing ENERGY STAR-manufactured homes. Any ENERGY STAR HUD-code homes in South Carolina are being shipped into the state by out-of-state manufacturers.” Supply constraints could impair the feasibility of this policy. However, this could also present an opportunity for economic development.

Status of Group Approval

Complete.

Level of Group Support

Unanimous.

Barriers to Consensus

Not applicable.