



**Residential, Commercial, and Industrial (RCI)
Technical Working Group**

Option No.	GHG Reduction Policy Option Name	GHG Reductions (MMtCO ₂ e)			Net Present Value (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	Level of Support
		2015	2025	Total (2008–2025)			
RCI-3	Green Building Guidelines and Standards Based on Architecture 2030	0.62	0.94	11.1	-\$296	-\$27	Approved

RCI-3. Green Building Guidelines and Standards Based on Architecture 2030

Policy Description

Promote, incentivize, or adopt green building guidelines and standards for the reduction of carbon emissions for all commercial and residential buildings consistent with *Architecture 2030* targets. Clearly communicate the fact that reducing energy use does not always proportionally reduce emissions. Consider developing disincentives to technologies that do not reduce emissions.

Require state and local government agencies including school districts to adopt required building guidelines and standards for the reduction of carbon emissions for all buildings consistent with *Architecture 2030* targets. New buildings must require the following reductions in carbon emissions:

2010	60% reduction
2015	70% reduction
2020	80% reduction
2025	90% reduction
2030	100% reduction

Specific energy targets for each building type are shown at: http://www.architecture2030.org/2030_challenge/2030_Challenge_Targets.pdf These would need to be converted into carbon emissions in a Minnesota context.

All guidelines and standards for major renovations of existing buildings must require reductions in carbon emissions consistent with the *Architecture 2030* target of 50% reduction. Provide a variance process when meeting criteria is not appropriate or financially unfeasible.

Track building energy performance and associated greenhouse gas (GHG) emissions during ongoing building operations.

Provide education and training for all key decision makers and those involved in implementation of this policy. Emphasize education for design professionals such as architects, engineers, interior designers, planners and landscape architects. Also include education for building owners, developers, contractors/builders, building operators/facility managers, financing, real estate and insurance communities.

Policy Design

Goals: As noted above

Timing: Program begins in voluntary form when law passes in June, 2008 and is in place with requirements and incentives on Jan. 1, 2010. The goal is to have program in place by 2010.

Parties Involved: Mandatory program is for all public building owners (state, county, city and school). Incentives and disincentives are for all private building owners (Residential, Commercial and Industrial). Research organizations should support this effort.

Implementation Mechanisms

The program should be implemented as follows:

- Pass legislation mandating that all state and local government agencies including school districts must meet *Architecture 2030* criteria for new and existing buildings. Provide funding mechanisms to assist state and local governments and school districts in meeting these criteria.
- Provide tax incentives, utility design assistance and incentive programs, financing incentives (such as “green mortgages”), or other inducements for construction of new and retrofit of existing residential and commercial buildings.
- Provide expedited code review for projects meeting certain energy and green building standards and benchmarks.
- Require designer (AE) to sign off on plans that the “best available energy technology” was used in completion of design, or explain why it wasn’t. Require building owner to sign off they have been informed of energy efficiency technologies by their design team, and accept the current design as meeting their requirements.
- Utilize performance contracting/shared savings arrangements as appropriate.
- Establish a database of ongoing building performance tracking in all sectors (building on existing database models).
- Establish a clearinghouse that provides information and assistance on green building guidelines and standards, the best available technologies for certain applications, a database of ongoing building performance tracking in all sectors, and access to design assistance and software tools to calculate the impacts of energy efficiency and renewable energy strategies buildings.
- Establish education programs for building professionals and other participants in implementing this policy.
- Mandate that State Boards of Licensing for building professionals cover knowledge of the improved building codes and building energy performance requirements reflected in various policy options in licensing exams.

Related Policies/Programs in Place

Guidelines that are either required or voluntary in Minnesota include: Minnesota Sustainable Building Guidelines (B3), LEED, Green Globes, NAHB Guidelines, GreenStar, Green Communities (Minnesota Housing Process), and Energy Star.

Existing federal and state tax credits. Need to inventory other current incentives in the state.

Current legislative goal of 100 LEED or Green Globes and 1000 Energy Star Buildings in Minnesota.

Existing continuing education mechanisms for professional education and development of new models as needed.

Type(s) of GHG Reductions

Reductions from avoided fossil-fuel combustion for electricity and space heating.

Estimated GHG Reductions and Net Costs or Cost Savings

Data Sources: The following sources were used in the analysis

- Minnesota GHG forecast developed for this process (based on the worksheet called “Energy Use and CO₂” in a spreadsheet called GHGemitsum07_Working.xls)
- Average Retail Price for Bundled and Unbundled Consumers by Sector, Census Division, and State, 2005, available at: http://www.eia.doe.gov/cneaf/electricity/esr/esr_sum.html
- Annual Estimates of Housing Units for the United States and States: April 1, 2000, to July 1, 2005, available at U.S. Census Bureau annual data, released at the end of every July: <http://www.census.gov/popest/housing/HU-EST2005.html>
- New Privately Owned Housing Units, Authorized Unadjusted Units for Regions, Divisions, and States, U.S. Census Bureau annual data, released at the end of every July, available at <http://www.census.gov/const/C40/Table2/t2yu200512.txt>
- 2001 EIA Residential Energy Consumption Survey, available at <http://www.eia.doe.gov/emeu/recs/recs2001/detailcetbls.html#space>
- Ratios of new residential/commercial floor space to total floor space, from EIA, available at <http://www.eia.doe.gov/emeu/cbecs/excel/b1.xls>
- Cooling degree-days in Minnesota, available from <http://lwf.ncdc.noaa.gov/oa/documentlibrary/hcs/cdd.200501-200607.pdf>
- Heating degree-days in Minnesota, available from Department of Commerce at: <http://lwf.ncdc.noaa.gov/oa/documentlibrary/hcs/hdd.200507-200607.pdf>
- Minnesota population projection, Minnesota State Demographic Center, available from <http://www.demography.state.mn.us/documents/MinnesotaPopulationProjections20052035.pdf>
- Utility electricity sales in 2005, available from U.S. Energy Information Administration at: <http://www.eia.doe.gov/cneaf/electricity/page/eia826.html>
- Sectoral electricity consumption, from EIA, available from U.S. Energy Information Administration, http://www.eia.doe.gov/cneaf/electricity/epa/epa_sprdshts.html (file sales_revenue.xls)
- The Energy Efficiency Task Force Report to the Clean and Diversified Energy Advisory Committee of the Western Governors Association: The Potential for More Efficient Electricity Use in the Western United States, January 2006, <http://www.westgov.org/wga/initiatives/cdeac/Energy%20Efficiency-full.pdf>

Quantification Methods: See Annex 1.

Key Assumptions: See Annex 2.

Key Uncertainties

New Privately Owned Housing Units; projected energy consumption in buildings

Additional Benefits and Costs

Reduced local air pollution

Feasibility Issues

None.

Status of Group Approval

Approved

Level of Group Support

Approved

Barriers to Consensus

None

Annex 2. Key Assumptions

RCI-3. Green Building Guidelines and Standards Based on Architecture 2030

Assumed CO2 reduction targets to meet the Architecture 2030 Challenge (% relative to Reference Case)																				
2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
0%	0%	0%	0%	0%	60%	62%	64%	66%	68%	70%	72%	74%	76%	78%	80%	82%	84%	86%	88%	90%

Percentage of new buildings subject to the new guidelines

1		
1	Use	80%
2	User-defined	

80% since not user-defined, ignore value in cell at left

Annual percentage of the existing building stock subject to renovation

1		
1	Use	5%
2	User-defined	

10% since not user-defined, ignore value in cell at left

Percentage of annual renovated building stock subject to the new guidelines

1		
1	Use	50%
2	User-defined	

50% since not user-defined, ignore value in cell at left

Real discount rate

1		
1	Use	5%
2	User-defined	

4% since not user-defined, ignore value in cell at left

Payback period for efficient equipment (years)

1		
1	Use	14
2	User-defined	

10 since not user-defined, ignore value in cell at left

Lifespan for efficient equipment (years)

1		
1	Use	30
2	User-defined	

30 since not user-defined, ignore value in cell at left

RCI-4. Incentives and Resources to Promote Combined Heat and Power (CHP)

Assumed start year for the new CHP facilities

2013

Assumption for CHP potential in MN based on most recent available estimates

1

1	Maximum of:	2,100 MW (default)
2	Minimum of:	1,600 MW (default)
3	User-defined	

Assumption for percentage of installed CHP by 2025

1

1	Up to specified potential (default)
2	User-defined

Marginal resource associated with electricity savings

1

1	coal & natural gas, prorata (default)
2	100% coal
3	system average

Combined heat and power (CHP) cost and performance

Parameter	2010					2025				
	NG	Biomass	Coal	electricity	oil	NG	Biomass	Coal	electricity	oil
Average full-capacity-equivalent hours of operation	5,000	5,000	5,000			5,000	5,000	5,000		
Fraction of new capacity	90%	5%	5%			83%	18%	0%		
Average net heat rate by fuel (btu per kWh)	10,000	13,000	12,000			10,000	13,000	12,000		
Useable cogenerated heat output (% energy input)	40%	40%	40%			40%	40%	40%		
Fraction useable heat output replacing space/water/process heat	90%	90%	90%			90%	90%	90%		
Fraction of CHP heat output displacing thermal energy	75%	5%	0%	15%	5%	75%	5%	0%	15%	5%
Net efficiency of displaced boiler/heater thermal energy	85%	80%	80%	92%	80%	85%	80%	80%	92%	80%
Average overnight installed capital costs by fuel type (2005\$/kW)	\$2,000	\$2,500	\$2,500			\$2,000	\$2,500	\$2,500		
CHP transmission cost (2005\$/kW)	\$0	\$0	\$0			\$0	\$0	\$0		
Economic life of system (years)	20	20	20			20	20	20		
Fixed O&M costs (2005\$/kW)	0	0	0			0	0	0		
Variable O&M costs (2005 \$/MWh)	16.00	20.00	20.00			16.00	20.00	20.00		

RCI-5. Program to reduce emissions of non-fuel, high-global-warming-potential GHGs

Still under development

RCI-6. Non-utility Strategies and Incentives to Encourage Energy Efficiency and Reduce

Start-up year for option

1		
1	Use	2013
2	User-defined	

Average energy savings from application of measures associated with non-utility strategies and incentives in the residential sector (% relative to Reference Case)

1		
1	Use	13%
2	User-defined	

Average energy savings from application of measures associated with non-utility strategies and incentives in the commercial sector (% relative to Reference Case)

1		
1	Use	13%
2	User-defined	

Average energy savings from application of measures associated with non-utility strategies and incentives in the industrial sector (% relative to Reference Case)

1		
1	Use	15%
2	User-defined	

Annual technical assistance visits to residential sector customers

1		
1	Use	10,000
2	User-defined	

Annual technical assistance visits to comercial sector customers

1		
1	Use	1,500
2	User-defined	

Annual technical assistance visits to industrial sector customers

1		
1	Use	300
2	User-defined	