Residential, Commercial, and Industrial (RCI) Technical Work Group

Summary List of Pending Policy Options for Analysis

Option No.	GHG Reduction Policy Option Name	GHG Reductions ($MMtCO_2e$)			Net Present Value (Million $)	Cost-Effectiveness ($/tCO_2e$)	Level of Support
		2015	2025	Total (2008–2025)			
RCI-1	Maximize Savings From the Utility Conservation Improvement Program (CIP)	5.64	13.10	122.6	–$5,824	–$48	UC
RCI-2	Improved Uniform Statewide Building Codes	0.004	0.005	0.1	–$31	–$402	UC
RCI-3	Green Building Guidelines and Standards Based on *Architecture 2030*	0.62	0.94	11.1	–$296	–$27	UC
RCI-4	Incentives & Resources To Promote Combined Heat and Power (CHP)	0.96	4.95	33.1	$1,009	$30	Pending
RCI-5	Program To Reduce Emissions of Non-Fuel, High-Global-Warming-Potential GHGs	0.02	0.05	0.5	–$2	–$5	UC
RCI-6	Non-Utility Strategies and Incentives To Encourage Energy Efficiency and Reduce GHG Emissions	0.25	1.30	8.3	–$307	–$37	Pending
RCI-7	Conservation Improvement-Type Program for Propane and Fuel Oil Efficiency	0.05	0.05	0.7	–$21	–$28	Pending
RCI-8	Energy Performance Disclosure	*Not quantified*					UC
RCI-9	Promote Technology-Specific Applications To Reduce GHG Emissions	*Not quantified*					UC
RCI-10	Support Strong Federal Appliance Standards and Require High State Standards in the Absence of Federal Standards	0.8	1.4	15.3	–$1,390	–$91	Pending
	Sector Total After Adjusting for Overlaps	**7.9**	**21.1**	**184.1**	**TBD**	**TBD**	
	Reductions From Recent Actions	**3.0**	**5.1**	**16.0**	**TBD**	**TBD**	
	Sector Total Plus Recent Actions	**10.9**	**26.2**	**190.1**	**TBD**	**TBD**	

UC = unanimous consent (These options were approved with unanimous consent with a proviso that certain language and details discussed at MCCAG's sixth meeting be incorporated.)

RCI-1. Maximize Savings From the Utility Conservation Improvement Program (CIP)

Policy Description

In 2007, the Minnesota legislature established an ambitious goal for energy efficiency: annual savings equal to 1.5 % of annual retail energy sales of electricity and natural gas. Utilities are required to demonstrate to the Commissioner of Commerce in their Energy Conservation Improvement Plans how those goals will be achieved.

The Minnesota Climate Change Advisory Group (MCCAG) recommends that the Minnesota Department of Commerce (DOC) work closely with the affected utilities and other parties to develop strategies and programs to achieve the increased energy savings goals in the new law. Such strategies and programs should include:

- Development and implementation of a state policy of "decoupling", or separation of utility sales from revenues**.**
- Development by utilities of a standardized portfolio of energy efficiency programs and program rebates that are designed to (1) overcome market barriers, such as lack of consumer knowledge of products and costs, and (2) capture overall system efficiencies—not just equipment efficiencies. For example, finding ways to improve the efficiency of the operation of an entire class of equipment or entire systems.
- Utilities should collaborate in joint efforts to achieve market transformation, to conduct market and product research, and to change consumer behavior. For example, the utilities should act to stimulate industry-wide efficiency changes and energy savings in products that consume electricity.
- The DOC should develop a standardized method for evaluating the success of utility programs.
- The state should seek to remove disincentives or regulations that inhibit energy efficiency.

Policy Design

Goals:

Timing: The DOC will begin June 1, 2008, with the exception of Xcel. The DOC will report back to the State Legislature on Conservation Improvement Program (CIP) goals by 2010.

Parties Involved: The program covers the residential, commercial, and industrial sector.

Other:

Implementation Mechanisms

To be determined (TBD).

Related Policies/Programs in Place

Minnesota natural gas and electric utilities' existing CIP programs.

Type(s) of GHG Reductions

Reductions from avoided fossil-fuel electricity generation and natural gas consumption **as a result of energy conservation programs.**

Estimated GHG Reductions and Net Costs or Cost Savings

Data Sources: The following sources were used in the analysis:

- Office of the Legislative Auditor, State of Minnesota, 2005, "Evaluation Report: Energy Conservation Improvement Program."
- Spreadsheet attachment in an e-mail from Peter Ciborowski to Bill Dougherty dated October 26, 2007.
- Minnesota legislation regarding the Conservation Improvement Program, 2007.

Quantification Methods: See Annex 1.

Key Assumptions: See Annex 2.

Key Uncertainties

Projected sales, program costs.

Additional Benefits and Costs

Reduced air pollution.

Feasibility Issues

TBD

Status of Group Approval

Approved.

Level of Group Support

Approved.

Barriers to Consensus

None.

RCI-2. Improved Uniform Statewide Building Codes

Policy Description

Building energy codes specify minimum energy efficiency requirements for new buildings or for existing buildings undergoing a renovation. Given the long lifetime of most buildings, amending state building codes to include minimum energy efficiency requirements and periodically updating energy efficiency codes will provide long-term GHG emission reductions.

The Minnesota Department of Labor and Industry (DOLI) has the responsibility of promulgating the building code in Minnesota. Where possible, the Department has approved the International Code Council's (ICC) "I" family of codes. In July 2007, the 2006 International Residential Code (IRC) and the 2006 International Building Code (IBC) were both adopted with Minnesota-specific amendments to address the Minnesota climate and building practices. Both were also adopted without their respective energy code chapters, as DOLI had been working for some time to amend Minnesota's existing energy code. DOLI decided some time ago that the 2006 IRC Chapter 11 (energy code chapter) would be adopted with Minnesota amendments.

Chapter 11 of the 2006 IRC is greatly simplified compared with past codes, and is expected to be widely accepted because of a U.S. Department of Energy (DOE) initiated amendment. That amendment allows builders to comply using a simple "cookbook" compliance method, without needing to perform computer calculations of window, wall, and other building component areas.

As a result of the high energy efficiency requirements required by code since 2000, Minnesota leads the nation in producing energy-efficient one- and two-family homes. Although the new residential code will not significantly increase the efficiency of one- and two-family residential buildings, its applicability will be broadened to include townhouses, and thus will increase their energy efficiency.

The new Minnesota Commercial Energy code is based on the American Society of Heating, Refrigerating and Air-Conditioning (ASHRAE) 91.1-2004 standard, with important state amendments. Though the percentage increase in energy efficiency is unknown at this time, it will be substantial if stakeholders understand its importance and install components correctly so that efficiencies are realized.

A policy to implement and enforce the commercial and residential energy codes statewide should be addressed legislatively. Following are some facts about the current energy code requirements:

- Approximately 85% of Minnesota's population lives in an area where the building code (including the energy code) has been adopted and enforced.
- Of Minnesota's 87 counties, 39 have adopted the State Building Code.
- In accordance with state law, virtually all cities with populations of 2,500 and above are enforcing the State Building Code, even if they are located in a county that is not enforcing the code.

- If a municipality or county chooses to enforce a building/energy code, it must be the Minnesota State Building Code. A municipality may not adopt a code that is more or less stringent than the Minnesota State Building Code.
- A statewide building code requirement would affect 48 sparsely populated counties—outside of any cities with populations of 2,500 and above—that have not adopted the Minnesota State Building Code.
- While the code is not enforced statewide, homebuilders who are licensed by the state are required to the build code-compliant homes regardless of location.

Additional measures to support the requirement that the building code be implemented statewide would include:

- Consumer and realtor education about the importance of energy efficiency.
- Improved enforcement of existing energy and mechanical codes.
- Training for code officials on energy code compliance and its importance.
- Training for builders, remodelers, and mechanical contractors on energy code compliance.
- Development of a clearinghouse for information on how to provide access to software tools to calculate the impact of energy efficiency and solar technologies on building energy performance.

Policy Design

Goals:

Timing:

When should the building codes be revised? What goals are to be achieved?

Recognizing that the State of Minnesota will be implementing a new commercial and residential energy code in 2008, other strategies that should be considered include:

- Implementing the energy code statewide in 2009 for all non-agricultural buildings. (Currently, agricultural buildings are exempt from building and energy code compliance).
- Every 3 years, updating energy codes that are at least as efficient as the most recently adopted version of ICC's energy codes.
    - Three-year cycles will allow Minnesota construction and renovation to keep consistent with the most recent ICC national code cycles, and will keep the construction industry updated with new materials and methods that increase energy efficiency. The 3-year cycle will also allow policy makers to address unintended consequences to durability or structural integrity caused by well-intentioned code changes.
- Mandating education on each new energy code cycle for:
    - Residential contractors seeking a Minnesota license;
    - Residential contractors renewing a Minnesota license;

  - All building code officials who perform energy efficiency or mechanical inspections; and
  - All architects registered in the State of Minnesota who approve building designs or renovations that affect energy use.
- Requiring all mechanical contractors in Minnesota to be licensed, and requiring a certain number of hours of continuing education on energy and mechanical code requirements during every new code cycle. *[Note: Need to determine appropriate number of hours.]*
- Developing an educational program for the public and realtors through the DOC's Energy Information Office, explaining Home Energy Rating System (HERS) scores for different types of housing.
  - Require all realtors to complete by 2011 at least 1.0 hour of continuing education about HERS ratings in existing and new residential homes.

Parties Involved: The buildings or projects covered include:

- Current Energy Code Rules under the State Building Code adopted on April 15, 2000, for one- and two-family residential buildings and on July 20, 1999, for commercial and residential buildings other than one- and two-family buildings. DOLI predicts that the new energy codes will go into effect in late 2007, or if there is a public hearing, by mid-2008.
- Minnesota Rules Chapter 7670 and Minnesota Rules Chapter 7672 cover new construction and remodeling of one- and two-family homes. Builders may choose either one, which has led to a lot of confusion for compliance and enforcement. These codes will be replaced by the new Residential Energy Code, Minnesota Rules Chapter 1322.

Minnesota Rules Chapter 7674 covers multifamily new construction and remodeling buildings that are three stories or less.

- Townhome units with separate entryways that do not share common spaces (e.g., hallways, laundry rooms, or foyers) will be covered under the new Residential Energy Code, Minnesota Rules Chapter 1322.
- Multifamily buildings that do not meet the townhome requirements for Chapter 1322 will be covered under the new Commercial Energy Code, Chapter 1323.

Minnesota Rules Chapter 7676 covers all buildings, except low-rise residential.

- All commercial buildings that do not meet the townhome requirements for Chapter 1322 will be covered under the new Commercial Energy Code, Chapter 1323.

Minnesota Rules Chapter 7678 covers requirements for insulation manufacturers to register uniform testing of energy efficiency and equipment manufacturers to register equipment efficiencies with the Minnesota DOC. Chapter 7678 will be repealed, as all of these requirements will be embodied in standards to be adopted by reference in Chapter 1322 or 1323.

Agricultural buildings as defined in Minnesota Statutes, section 16B.60, and subdivision 5 are exempt from the Minnesota State Building Code.

Implementation Mechanisms

Mandating the code statewide requires a statute revision by the Minnesota Legislature. DOLI has developed a *Minnesota State Building Code Adoption Guide* for local jurisdictions. See: http://www.doli.state.mn.us/pdf/bc_pr_code_adoption_guide_1_06update.pdf

DOLI should implement code revisions using the rulemaking process, which allows for public input.

Related Policies/Programs in Place

Minnesota Rules Chapters 7670, 7672, 7674, 7676, and 7678. See: http://www.mncodes.org/energy.htm

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:

- 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, U.S. Census Bureau annual data, released at the end of every July, available at: 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 U.S Energy Information Administration (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
- DOC-published cooling degree-days in Minnesota, available at: http://lwf.ncdc.noaa.gov/oa/documentlibrary/hcs/cdd.200501-200607.pdf
- DOC-published heating degree-days in Minnesota, available at: http://lwf.ncdc.noaa.gov/oa/documentlibrary/hcs/hdd.200507-200607.pdf
- Minnesota population projection, Minnesota State Demographic Center, available at: http://www.demography.state.mn.us/documents/MinnesotaPopulationProjections20052035.pdf
- EIA-published Utility electricity sales in 2005, available at: http://www.eia.doe.gov/cneaf/electricity/page/eia826.html
- EIA-published sectoral electricity consumption data, from, available at: http://www.eia.doe.gov/cneaf/electricity/epa/epa_sprdshts.html (file sales_revenue.xls)

- 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, available at: http://www.westgov.org/wga/initiatives/cdeac/Energy%20Efficiency-full.pdf

Quantification Methods: See Annex 1.

Key Assumptions: See Annex 2.

Key Uncertainties

Projected economic growth rate in counties not covered by the current codes.

Additional Benefits and Costs

Uniform standards, reduced air pollution.

Feasibility Issues

TBD

Status of Group Approval

Approved.

Level of Group Support

Unanimous consent.

Barriers to Consensus

None.

RCI-3. Green Building Guidelines and Standards Based on *Minnesota 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 *Minnesota 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 *Minnesota 2030* targets. Standards shall include a process for appeal when the project demonstrates an inability to meet the criteria or is financially infeasible.

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

All guidelines and standards for major renovations of existing buildings must require reductions in carbon emissions consistent with the *Minnesota 2030* target of 50% reduction. Standards must include a process for appeal and subsequent exemption from the requirements when the project demonstrates an inability to meet the criteria or is financially infeasible.

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, and financing, real estate, and insurance communities.

Policy Design

Goals:

Timing: The program begins in voluntary form when law passes in June 2008. It will become mandatory on January 1, 2010, after final revision of requirements and additional incentives.

Parties Involved: The 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 *Minnesota 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 designers (architects and engineers) to sign off on plans that the best available energy technology was used in the completion of the design, or to explain why it was not. Require building owners to sign a form saying they have been informed their design team about energy efficiency technologies by, and they accept the current design as meeting their requirements.
- Utilize performance contracting and 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 on buildings.
- Establish education programs for building professionals and other participants in implementing this policy.
- Mandate that state boards of licensing for building professionals cover in licensing exams knowledge of the improved building codes and building energy performance requirements reflected in various policy options.

Related Policies/Programs in Place

Guidelines that are either required or voluntary in Minnesota include Minnesota Sustainable Building Guidelines (B3), Leadership in Energy and Environmental Design (LEED), Green Globes, National Association of Home Builders (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 1,000 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 CO_2" 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, U.S. Census Bureau annual data, released at the end of every July. available at: 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
- DOC-published cooling degree-days in Minnesota, available at: http://lwf.ncdc.noaa.gov/oa/documentlibrary/hcs/cdd.200501-200607.pdf
- DOC-published heating degree-days in Minnesota, available at: http://lwf.ncdc.noaa.gov/oa/documentlibrary/hcs/hdd.200507-200607.pdf
- Minnesota population projection, Minnesota State Demographic Center, available at: http://www.demography.state.mn.us/documents/MinnesotaPopulationProjections20052035.pdf
- EIA-published utility electricity sales in 2005, available at: http://www.eia.doe.gov/cneaf/electricity/page/eia826.html
- Sectoral electricity consumption data, from EIA, available at: 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, available at: 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

TBD

Status of Group Approval

Approved.

Level of Group Support

Approved.

Barriers to Consensus

None.

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

Policy Description

Combined heat and power (CHP) systems utilize heat generated by the production of electricity (which would otherwise be lost), primarily to produce steam for industrial or heating purposes. CHP systems reduce fossil fuel use and GHG emissions, both through their improved efficiency relative to separate heat and power technologies, and by avoiding transmission and distribution losses associated with moving power from central power stations located far from where the electricity is used. This policy option should include the following:

- Promotion of the use of natural gas-fired CHP systems.
- Promotion of the use of biomass-fired CHP systems.
- Creation or expansion of markets for, and incentives designed to promote implementation of, CHP units in capacities suitable for residential, commercial, and industrial building users.
- Provision of tax benefits, attractive financing arrangements, utility rebates, and other incentives to promote CHP technologies.
- Removal of barriers to CHP development, such as utility rate structures (discounted electric rates that compete with CHP) and interconnection standards (should be designed to facilitate economical and efficient CHP connection to the grid).
- Full consideration of the economic and environmental benefits of CHP as a resource in each electric utility's Integrated Resource Plan.
- Integration of this option with MCCAG Energy Supply work.

Potential supporting measures for this option include training and certification of installers and contractors, net metering and other pricing arrangements, establishment of clear and consistent interconnection standards, and creation and support of markets for biomass fuels.

Policy Design

Goals: The goal of this Policy Option is that CHP opportunities be promoted and implemented by 2025. A recent study has estimated that approximately 2,100 megawatts (MW) of CHP opportunity are available in Minnesota. However, there are several market barriers to CHP, as described above, and it is unlikely that full implementation will occur. The RCI TWG has based its analysis on achieving 50% of the CHP market potential by 2025 (i.e., 1,050 MW), which is considered to be aggressive and will require substantial market support.

Timing: Legislation supporting the CHP initiative could be introduced in the 2008 Legislature. Any tax incentives or utility promotions could begin in 2010. The direct reduction of GHG emissions through increased CHP could occur by 2012.

Parties Involved: Residential, commercial, and industrial users; gas and electric utilities; state agencies, such as the DOC.

Other:

Implementation Mechanisms

The promotion of CHP should occur through financial and/or tax incentives for customers installing CHP systems, through utility rate incentives and interconnection standards, and through inclusion in utility resource planning processes. It is anticipated that any financial or tax incentives could be phased out as CHP projects become more cost-effective and accepted by the market.

Related Policies/Programs in Place

It is possible that certain CHP projects could also qualify for a utility rebate.

Type(s) of GHG Reductions

Reductions from avoided fossil-fuel emissions (primarily electricity) as a result of more efficient on-site production of heat and electricity to buildings and industrial facilities through a CHP process.

Estimated GHG Reductions and Net Costs or Cost Savings

Data Sources: The following sources were used in the analysis:

- Form EIA-906, available at: http://www.eia.doe.gov/cneaf/electricity/epa/epa_sprdshts.html
- Inventory of Cogeneration Potential in Minnesota, Minnesota Planning, Minnesota Environmental Quality Board, August 2001, page iv, available at: http://www.eqb.state.mn.us/pdf/2001/CogenInventory.pdf
- EIA, "Assumptions to the Annual Energy Outlook 2007 Report," DOE/EIA-0554, April 2007, available at: http://www.eia.doe.gov/oiaf/aeo/assumption/pdf/electricity.pdf

Quantification Methods: See Annex 1.

Key Assumptions: See Annex 2.

Key Uncertainties

- Ability of end-use customers, primarily industrial, to fund and implement potential CHP projects to obtain the projected 1,050-MW level by 2025. To obtain this level, public and private funding of CHP projects would need to be approximately $2.2 billion.
- Achievement of 50% of CHP market potential by 2025.
- Avoided costs as developed by the Energy Supply TWG.

Additional Benefits and Costs

CHP projects are projected to be cost-effective (benefits exceed costs), using a life-of-the-project analysis.

Feasibility Issues

A recent study provides support for CHP market potential. Feasibility issues primarily revolve around the cost of installing CHP projects and the other market barriers described previously. Economic and policy support of CHP will be required to implement at the projected level.

Status of Group Approval

Pending (until MCCAG moves to final agreement at meeting #7).

Level of Group Support

TBD (blank until MCCAG meeting #7).

Barriers to Consensus

TBD (blank until MCCAG final vote).

RCI-5. Program To Reduce Emissions of Non-Fuel, High-Global-Warming-Potential GHGs

Policy Description

High-potential GHGs (HPGHGs) include the hydrofluorocarbons (HFCs) perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). The HFCs and PFCs are classes of chemical species rather than individual species. The United States is a signatory to the United Nations Framework Convention on Climate Change and is required to report emissions of these gases annually. The intent of this proposal is to address those gases reported by the U.S. Environmental Protection Agency (EPA) pursuant to that convention, excluding carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and gases controlled by the Montreal Protocol on Substances That Deplete the Ozone Layer. See: http;//www.ipcc-wg1.ucar.edu/wg1/Report/AR4WG1_Print_Ch02.pdf

Some of the HPGHGs have a global warming effect of up to 23,000 times the impact of CO_2. For example, 1 pound of $SF_6$is equal to the global warming impacts of 11 tons of CO_2.

In many cases, the cost of reducing these gases can be very low. Thus, an overall percentage reduction of GHGs (including CO_2) will be more cost-effective if this subject is effectively addressed at an early date.

The major sources include

- Air conditioning (mobile),
- Refrigerants,
- Aerosols and aerosol products,
- Foam insulations,
- Aluminum smelting,
- Electric power systems,
- Semiconductor manufacture,
- Solvents, and
- Fire extinguishers.

In many cases, alternative substances or methods are available. Also, the maintenance and disposal of equipment or building materials that contain these substances can be a large source of emissions. EPA's Web site on this subject (http://www.epa.gov/highgwp/projections.html) states: "EPA is actively working to reduce emissions of high GWP gases given their potency and long atmospheric lifetimes. Through a set of voluntary partnerships, EPA and industry are making substantial progress in reducing emissions by developing and implementing cost-effective improvements to industrial processes."

For example, EPA held a seminar to instruct utilities on proper methods of decommissioning equipment containing SF_6. EPA has established voluntary partnerships in the electrical, aluminum, semiconductor, and magnesium industries. In addition, EPA has published a list of acceptable substitutes for ozone-depleting substances, which are controlled by the Montreal Protocol. See: http://www.epa.gov/ozone/snap/index.html

EPA's Web site also contains extensive information on the costs of control at: http://www.epa.gov/highgwp/projections.html

See also the "Meeting Report of the Joint IPCC/TEAP on Options for the Limitation of Emissions of HFCs and PFCs." Petten, May 1999, available at: arch.rivm.ni/env/int/ipcc/docs/IPCC-TEAP99/files/IPCC_TEAP(1999).pdf

Slide 83 of the First Meeting of the MCCAG demonstrates a dramatic growth in the emission of these substances, absent some remedial measures.

Policy Design

1. Elimination of Emissions of High-Potential Global Warming Gases (HPGWGs) at Reasonable Cost

The MCCAG recommends that the Minnesota Pollution Control Agency (MPCA) undertake a rulemaking process to identify uses and emission sources of HPGWGs, and to eliminate the use of such gases where that can be done at a reasonable cost.

- The rulemaking process should include an initial scoping process to determine:
  - Which industries are the subject of an EPA voluntary partnership, or some other voluntary program or EPA regulation resulting in reasonable measures to reduce emissions of HPGWGs.
  - In industries that are the subject of an EPA voluntary partnership or some other program, which of the companies in Minnesota in those industries have taken reasonable measures to reduce their emissions of HPGWGs.
  - On the basis of the scoping process, MPCA should determine which industries should be exempt from the rulemaking process, because they are voluntarily making all reasonable reductions in emissions of HPGWGs that can be accomplished at reasonable costs. Individual companies not participating in such industry programs would not be exempt, nor would industries or companies where reductions of emissions that are possible at reasonable costs are not being achieved.
  - To the extent that tradable credits result from the rulemaking process for reductions in emission, MPCA should develop a mechanism to provide such credits for companies that have reduced such emissions voluntarily.
- The rulemaking process of the MPCA would:
  - Require the elimination of such gases, on a phased basis, where this can be done at a zero or negative cost.
  - Require the elimination or reduction of such gases by the use of prudent managerial practices, process changes, and improved technology, or by substitution of other

substances or means where the cost of CO_2e (CO_2 equivalent) reduction can be accomplished at a reasonable cost.

- The reasonable cost per tCO_2e (ton of CO_2 equivalent) reduction should be established by MPCA in the rulemaking process, taking into account the availability of alternatives, but should not be less than $15 per tCO_2e, or 25% of the average cost of control of all GHGs per tCO_2e across all sectors and sources, whichever is greater, as determined by the agency.

2. Promotion and Funding for Process Optimization

- Where the elimination of HPGWGs can be undertaken at a reasonable cost, that should be accomplished through the rulemaking process where it has not been done voluntarily through the EPA programs or otherwise. In other cases, the state should provide funding and incentives for the reduction and phase-out of HPGWGs, through tax incentives and funding for programs that offer education and technical assistance.
- The EPA Web site describes voluntary programs in several industries. See: http://www.epa.gov/highgwp/sources.html

3. Use of Lower-Impact Alternatives for Coolants, Refrigerants, Aerosols, Solvents, and Insulation

- Again, where substitutes can be used at a reasonable cost, that should be done, pursuant to the rulemaking described above if not voluntarily. Where substitutes are not available at reasonable costs, the state should undertake to reduce the use and emissions of HPGWGs through incentives and through the funding of programs that can provide technical assistance.
- See EPA's Web site: http://www.epa.gov/ozone/snap/

Implementation Mechanisms

MPCA.

Legislative action to provide tax incentives, and funding for technical support and assistance.

Technical support through the Minnesota Technical Assistance Program (MnTAP) or similar entities.

Related Policies/Programs in Place

MnTAP.

Type(s) of GHG Reductions

Reductions from avoided emissions of HPGHGs.

Estimated GHG Reductions and Net Costs or Cost Savings

Data Sources:

- "U.S. High GWP Gas Emissions 1990–2010: Inventories, Projections, and Opportunities for Reductions," June 2001 (available at http://www.epa.gov/highgwp/projections.html)

- Population projections from the Minnesota State Demographic Center, available at:http://www.demography.state.mn.us/documents/MinnesotaPopulationProjections20052035.pdf
- National population projections from the U.S. Census Bureau, available at: http://www.census.gov/population/projections/SummaryTabA1.xls
- California staff Analysis of Proposed Early Action for Climate Change Mitigation in California, 2007, HFC for Mobile Air Conditioning, available at: http://www.arb.ca.gov/cc/ccea/hfc-mac/documents/hfcdiy.pdf

Quantification Methods: See Annex 1.

Key Assumptions: See Annex 2.

Key Uncertainties

Costs of achieving reductions.

Additional Benefits and Costs

None.

Feasibility Issues

TBD

Status of Group Approval

Approved.

Level of Group Support

Unanimous consent.

Barriers to Consensus

None.

RCI-6. Non-Utility Strategies and Incentives To Encourage Energy Efficiency and Reduce GHG Emissions

Policy Description

This policy option implements cost-effective non-utility strategies and incentives **for industrial processes in manufacturing and commercial facilities** that complement (but do not duplicate) utility-based programs to reduce GHG emissions through energy efficiency (E2) and adoption of renewable energy technologies. These strategies must include mechanisms to:

- Maximize convenience for program users/participants;
- Capture overall technology and system efficiencies;
- Conduct research, evaluation, and analysis of E2 opportunities;
- Provide market, cost, and other incentives to implementation;
- Remove disincentives and/or regulatory barriers;
- Partner with appropriate groups; and
- Provide technical assistance for implementation of energy-efficient technologies.

The proposed programs, strategies, and mechanisms fall into four categories: technical assistance for implementation of E2 and renewable energy, tax incentives or benefits, state economic assistance, and direct reduction of GHGs from industry.

Implementation Mechanisms

1. **Technical Assistance—Voluntary, Nonregulatory Assistance for Residential/Commercial/Industrial Entities as a Mechanism To Implement Policies and Expand Related Programs That Would Result in GHG Reductions Through Energy Efficiency Savings and Adoption of Renewable Energy Technologies**

- Provide **technical assistance to industrial and commercial facilities**, including
  - Site assessments and student intern projects for E2 opportunities related to compressed air, steam systems, process heat, process refrigeration, pumps, fans, motors, etc.;
  - E2 technology demonstrations and pilots;
  - Resource development, including Web resources and best practices documents;
  - Workshops and seminars, including DOE best practices training;
  - Partnering with relevant industry associations and utilities; and
  - Evaluation of renewable energy technologies.
- Assist industries with implementation of **the low-hanging fruit of energy savings** through the above services. Four categories that seem to be easy to implement with quick payback are process-related insulation, steam traps, lighting, and compressed air.
- Assist in the formation of **process energy conservation teams** within industrial facilities, or within an industry sector working with industry associations. The people in the plant have the

most knowledge about their process, but they may get stalled on implementation. Energy conservation teams would be best suited initially for the quick hits that come from focusing on operation and maintenance activities. Over time, these groups will provide the ideas for the larger capital projects.

- Assist facilities that run their own boilers to look at **optimizing the operation of the steam system.** Examples include right-sizing boilers, waste-heat recovery from steam systems, boiler turndown, load balancing for buildings with multiple boilers, and improvements to boiler efficiency.
- Develop **benchmarks for industrial operations** where they do not exist or are not widely known, for industrial and commercial facilities or operations. The EPA Energy Star program currently has three industries (cement manufacturing, wet corn milling, and auto manufacturing) that have specific energy performance indicators that can be used to benchmark a facility to help prioritize where efforts should be focused. The energy performance indicator for a cement plant is based on the total amount of energy required to produce a short ton or MMBtu/short ton of clinker. Focus groups could be formed to promote energy conservation in high-energy-use industries.
- Promote and develop information and resources, and provide assistance for the following **industrial energy-efficient technologies** that are not frequently used but that help reduce GHG emissions:
  - Waste-heat recovery (e.g., metal casting),
  - Pumping systems (potential 20% savings),
  - Combined heat and power (cogeneration), and
  - Boiler blow-down heat exchangers or flash-steam recovery systems.
- Have an outside party **work with utilities and companies to track why energy-efficient and renewable energy technologies are not being implemented**. This work would be "field proofing" ideas about barriers, such as getting industry feedback before beginning on a project. If this information already exists, it could be useful guidance on how to improve implementation.

2. Direct Reduction of GHGs From Industry (in Addition to RCI-5 and Others)

- **Encourage the reduction of industrial emissions of GHGs (defined as climate change GHGs, including CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6)** from industries that have the greatest volumes: food processing, ethanol, petroleum refining, and taconite mining. This could be achieved via voluntary initiatives, technical assistance, best practices checklists, policy (cap and trade), and/or regulatory and other incentives. Educate industries that these activities result in carbon-offset credits that they can use as revenues.

3. Tax Incentive Programs (not already in place)

- **Provide tax incentives for capital equipment that reduces energy use per unit of product by more than 10% (possibly on a sliding scale).** Projects would be conducted in collaboration with applicants' local utility. To protect public interest, applicants would adhere to the same measurement and verification protocols required by the DOC of Minnesota utility CIP custom E2 projects of similar size. Equipment suppliers or businesses would need to measure energy consumption before and after installation of equipment.

- **Offer tax incentives for specific technologies (i.e., pumps, motors, fans, boilers, compressed air systems) known to deliver energy efficiency.** National Electrical Manufacturers Association (NEMA) premium motors and adjustable speed drives in the right applications are possible technologies, but there are many others. The EPA and DOE Web sites list many Energy Star products for commercial facilities (e.g., food, service, lighting, office equipment) that could be given a tax incentive. This would be the simplest to administer because no verification (other then receipt for filing taxes) would be needed. Exempting qualifying items from sales tax would be even simpler to administer, such as is done for groceries. To protect public interest, applicants would use the same measurement and verification protocols required by the DOC of Minnesota utility CIP prescriptive E2 projects.
- **Identify the large energy users and offer a tax incentive for energy reduction per ton of production.** Discussions may be needed to determine what size credit might serve as an incentive. Large energy users are probably relatively efficient now, but still represent a substantial opportunity. A screening of energy intensity per ton of product may be needed to determine if variation in credit is warranted. Facility benchmarks might be available, but not shared with the public. Pre- and post-testing would help ensure savings are achieved.
- **Offer tax incentives for facilities that can move into the top 10% of a benchmark**. Various building energy benchmarks (energy/ft^2) exist for different sectors (schools, warehouses, churches). For example, a credit could be provided for facilities that achieve the top 10% or 25% of a benchmark, or facilities could receive a credit based on how far they move toward conservation. An existing federal program grants a tax deduction of $1.80 per ft^2 for reducing energy consumption by 50% or more. If the reduction is at least 16.67%, the tax deduction is $0.60 per ft^2. The program requires using DOE-approved software programs to calculate the energy savings.

3. Tax Incentive Programs (not already in place)

- **Offer tax incentives for capital equipment that reduces energy use per unit of product by more than 10%** (that would be the benchmark). Projects would be conducted in collaboration with applicants' local utility. To protect public interest, applicants would adhere to the same measurement and verification protocols required by DOC of Minnesota utility CIP custom E2 projects of similar size. It might be possible for them to provide DOC with equipment invoices, and pre-project energy use and production data (nonpublic) and post-project data that showed 10% improvement as a means to provide some safeguard to protect public interest. There needs to be some method of verifying claims and evaluating cause-and-effect behavior change. Equipment suppliers or businesses would need to measure energy consumption before and after installation of equipment.
- **Offer tax incentives for specific technologies (i.e., pumps, motors, fans, boilers, compressed air systems) known to deliver energy efficiency.** National Electrical Manufacturers Association (NEMA) premium motors and adjustable speed drives in the right applications are possible technologies, but there are many others. The EPA and DOE Web sites list many Energy Star products for commercial facilities (e.g., food, service, lighting, office equipment) that could be given a tax incentive. This would be the simplest to administer because no verification (other then receipt for filing taxes) would be needed. Exempting qualifying items from sales tax would be even simpler to administer, such as is

done for groceries. While quantifying energy savings and resulting GHG reductions would be a wild card, because baselines would not be known, sales of the selected projects could be tracked to develop estimates. Naturally, targeted marketing would be necessary with any behavior-change project. Projects would be conducted in collaboration with applicants' local utility. To protect public interest, applicants would use the same measurement and verification protocols required by DOC of Minnesota utility CIP prescriptive E2 projects.

- **Identify the large energy users and offer a tax incentive for energy reduction per ton of production.** Discussions may be needed to determine what size credit might serve as an incentive. Large energy users are probably relatively efficient now, but still represent a substantial opportunity. A screening of energy intensity per ton of product may be needed to determine if variation in credit is warranted. Facility benchmarks might be available, but not shared with the public. Pre- and post-testing would help ensure savings are achieved.
- **Offer tax incentives for facilities that can move into the top 10% of a benchmark**. Various building energy benchmarks (energy/ft^2) exist for different sectors (schools, warehouses, churches). For example, a credit could be provided for facilities that achieve the top 10% or 25% of a benchmark, or facilities could receive a credit based on how far they move toward conservation. An existing federal program grants a tax deduction of $1.80 per ft^2 for reducing energy consumption by 50% or more. If the reduction is at least 16.67%, the tax deduction is $0.60 per ft^2. The program requires using DOE-approved software programs to calculate the energy savings.
- **Provide tax incentives for reducing GHGs by adopting renewable energy technologies, such as biomass, biofuels, and biogas.** These technologies reduce GHG emissions by offsetting the use of fossil fuels.

4. State Economic Assistance

- **Offer low- or no-interest loans or other economic assistance** for companies that do audits, identify energy goals, implement their energy-efficient technologies, or are doing their first energy project, The loans may require that an energy analysis be performed to calculate the energy savings that will be achieved, which will help ensure the loan will be paid off.
- **Conduct a review of all Minnesota economic development assistance projects to ensure that they encourage or require state-of-the-art efficiency and environmental technologies** (key to Minnesota industrial competitiveness).
- **Promote and pilot test performance contracting in energy areas**. Performance contracting is defined as a contract between a building owner and a contractor for the purpose of saving energy in the owner's building. The contractor agrees to research, design, build, and maintain capital improvements that are expected to save energy and dollars. The owner agrees to pay the contractor from savings realized during the contract period.

Policy Design

Goals—Program Begins:

Tax benefits: 2010
Technical assistance: 2008–2009
State economic assistance: 2010
Direct reduction of GHGs from industry: 2010

Goals—Goals Achieved:

Tax benefits: 2012
Technical assistance: 2010
State economic assistance: 2012
Direct reduction of GHGs from industry: 2012

Parties Involved:

Tax benefits: residential, commercial, industrial
Technical assistance: commercial, industrial
State economic assistance: residential, commercial, industrial
Direct reduction of GHGs from industry: industrial

Type(s) of GHG Reductions

- Reductions from avoided fossil-fuel electricity generation as a result of implementation of energy-efficient practices and technologies.
- Reductions of industrial-based GHGs of CH_4 and N_2O.

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 CO_2" in a spreadsheet called GHGemitsum07_Working.xls)
- Residential and commercial electricity customers, available at: http://www.eia.doe.gov/cneaf/electricity/epa/epa_sprdshts.html
- 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, U.S. Census Bureau annual data, released at the end of every July, available at: 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
- DOC-published cooling degree-days in Minnesota, available at: http://lwf.ncdc.noaa.gov/oa/documentlibrary/hcs/cdd.200501-200607.pdf
- DOC-published heating degree-days in Minnesota, available at: http://lwf.ncdc.noaa.gov/oa/documentlibrary/hcs/hdd.200507-200607.pdf

- Minnesota population projection, Minnesota State Demographic Center, available at: http://www.demography.state.mn.us/documents/MinnesotaPopulationProjections20052035.pdf
- Utility electricity sales in 2005, from EIA, available at: http://www.eia.doe.gov/cneaf/electricity/page/eia826.html
- Sectoral electricity consumption, from EIA, available at: 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, available at: http://www.westgov.org/wga/initiatives/cdeac/Energy%20Efficiency-full.pdf
- Kenneth Gillingham, Richard Newell, and Karen Palmer, "Retrospective Examination of Demand-Side Energy Efficiency Policies," Discussion Paper, June 2004; revised September 2004 RFF DP 04-19 REV, 2004, Resources for the Future.

Quantification Methods: See Annex 1.

Key Assumptions: See Annex 2.

Related Policies and Programs in Place

Tax benefits: Commerce? Revenue?

Technical assistance: Build on existing E2 services of the MnTAP at the University of Minnesota (for manufacturers) and the Center for Energy and the Environment (for small businesses and commercial firms).

State economic assistance: Minnesota DOC, State Energy Office grants, MPCA grants and loans.

Direct reduction of GHGs from industry: MnTAP and others.

Other Related Policies/Programs in Place

Minnesota DOC and CIP.

The goals of utility conservation programs are to promote consumer and industry awareness of energy conservation and its positive effect on the environment, reduce utility bills for homes and businesses, generate innovations in developing energy-efficient products and technologies, and promote new energy resource development.

Next Generation Act of 2007: It is the energy policy of the State of Minnesota to achieve annual energy savings equal to 1.5 percent of annual retail energy sales of electricity and natural gas directly through energy conservation improvement programs and rate design, and indirectly through energy codes and appliance standards, programs designed to transform the market or change consumer behavior, energy savings resulting from efficiency improvements to the utility infrastructure and system, and other efforts to promote energy efficiency and energy conservation.

Section 1605b of the 1992 Energy Policy Act (Public Law 102-485) mandated the creation of a national inventory of GHGs and a national database of voluntary reductions in GHG emissions. In doing so, Section 1605b directed DOE to establish a procedure for voluntary annual reporting of GHG emissions and emission reductions by companies from the year 1987 forward.

DOE runs a suite of programs dedicated to improving the energy efficiency of buildings, including Building America, Rebuild America, the High Performance Buildings Initiative, and the Zero Energy Buildings Initiative. All of these programs work through the development of voluntary public-private partnerships.

DOE's Office of Industrial Technologies runs two programs primarily focused on industrial energy audits: Industrial Assessment Centers and Plant-wide Assessments.

The Partnership for Advanced Technology in Housing program is a voluntary public-private partnership between homebuilders, product manufacturers, insurance companies, and financial companies and the U.S. Department of Housing and Urban Development. It is dedicated to improving residential housing's energy efficiency, affordability, durability, environmental sustainability, and resistance to natural disasters.

Energy Star is an umbrella term encompassing a broad range of programs, all designed to encourage energy-efficient investments.

DOE's Weatherization Assistance Program (WAP) was authorized in 1976 under Title IV of the Energy Conservation and Production Act (Public Law 94-385) to fund weatherization measures for low-income households to reduce their energy use. WAP prioritizes services to low-income families with children, the elderly, and people with disabilities, and low-income households with a high energy burden. The program works through partnerships between DOE and state and local agencies to which DOE provides program grants.

The DOE Climate Challenge program is a voluntary partnership between electric utilities and DOE designed to facilitate voluntary GHG emission reductions by utilities.

Key Uncertainties

Cost-effectiveness of technical assistance visits.

Additional Benefits and Costs

Reduced local air pollution.

Feasibility Issues

Measuring the effectiveness or total energy savings from a conservation initiative or program can be problematic due to difficulties in defining the right baseline, failure to correct for free riding or the "rebound" effect, use of inappropriate discount rates, and double counting of the same energy savings attributed to multiple government programs. A major question that arises when measuring program costs or cost-effectiveness is whether all of the salient costs (to business, to consumers, including consumer surplus losses due to quality changes, and to the government) are being accounted for. Equally important, the benefits of the programs (including otherwise

unaccounted-for spillovers) must be properly accounted for. All of these issues combined suggest that considerable care must be taken in interpreting existing estimates of the effectiveness and cost of E2 programs.

Status of Group Approval

Pending approval.

Level of Group Support

Pending approval.

Barriers to Consensus

Quantification of total costs.

RCI-7. Conservation Improvement-Type Program for Propane and Fuel Oil Efficiency

Policy Description

This policy option implements cost-effective programs to reduce propane and fuel oil use; target rebates to overcome market barriers; maximize convenience to program participants; capture overall system efficiencies, not just equipment efficiencies; create joint efforts to achieve market transformation; support ongoing research, evaluation, and analysis; complement government, utility, and non-utility efficiency programs; and seek to remove any disincentives or regulatory barriers to energy efficiency.

Policy Design

Goals:

- Establish minimum efficiency heating plant standards consistent with DOE's Energy Star program. Initiate a rebate program for new and replacement heating units meeting the current Energy Star efficiency standards of 80% for fuel oil and 85% for propane (including water heating).
- Establish and implement a plan for inspection and tune-up of all existing in-use heating systems, and establish an inspection cycle. This plan should include inspection of fuel storage and delivery systems. Inspections are to be conducted and certified by certified and trained personnel.
- Remove fuel rate disincentives and penalties for reduced energy consumption as a result of installing high-efficiency heating equipment.
- Provide low-interest loans for low-income households to encourage installation of higher-efficiency models.
- Encourage manufactures to take advantage of new technological developments, such as alarm systems for fuel leaks and component failure (e.g., filter plug, restricted heat exchanger).
- Provide public recognition to individuals or companies that are successful leaders in promoting E2 standards.

Timing: All goals must be initiated and progress evaluated by 2009.

Parties Involved: All parties with interest.

Other:

Implementation Mechanisms

Create an ongoing state task force of consumers, state agencies, utilities, and business representatives to annually review CIP initiatives and make changes according to program effectiveness, technological changes, and critical fuel changes.

Related Policies/Programs in Place

Xcel's CIP Program.

Type(s) of GHG Reductions

Reductions from avoided propane and fuel oil combustion.

Estimated GHG Reductions and Net Costs or Cost Savings

Data Sources:

- Minnesota GHG forecast developed for this process (based on the worksheet called "Energy Use and CO_2" in a spreadsheet called GHGemitsum07_Working.xls)
- Annual Estimates of Housing Units for the United States and States: April 1, 2000 to July 1, 2005, U.S. Census Bureau annual data, released at the end of every July, available at: 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
- 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
- Regional prices for fuel oil and propane, from the EIA Annual Energy Outlook 2007 (AEO2007) estimates for the West North Central region, available at: http://www.eia.doe.gov/oiaf/aeo/supplement/
- Minnesota natural gas prices, from the EIA, available at: http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_SMN_a.htm

Quantification Methods: See Annex 1.

Key Assumptions: See Annex 2.

Key Uncertainties

Ramp-up period for achieving efficiency improvement, projected costs of fuel oil and propane.

Additional Benefits and Costs

Reduced local air pollution.

Feasibility Issues

TBD

Status of Group Approval

Pending (until MCCAG moves to final agreement at meeting #7).

Level of Group Support

Pending (until MCCAG moves to final agreement at meeting #7).

Barriers to Consensus

Pending (until MCCAG moves to final agreement at meeting #7).

RCI-8. Energy Performance Disclosure

Policy Description

To engage Minnesota's utility consumers in actively considering efficiency and environmental impacts when using energy or purchasing energy-consuming appliances, this policy option proposes the following:

- Utilities should provide an energy performance disclosure to parties owning any public, commercial, or residential property, preferably in an electronic format. This information should be made available by the property owner to the prospective buyer or renter to allow for energy efficiency and environmental impacts to be an integral part of the decision to buy or rent.
- Utilities should provide energy consumption history to the owner to share with a prospective purchaser or renter of the property. Owners would be obligated to provide the performance disclosure of their account for the term of their ownership, up to a maximum of the 12 most recent months. Additional information that would continue to encourage sound energy decisions, such as a rating factor based upon kBtu/square foot/year (from the owner) and CO_2 emissions (from the utility company), should also be included.
- A task force of utilities and parties of concern should be developed to devise a uniform utility information standard that would provide relevant energy efficiency and environmental impact information to customers. For example, such information might indicate the incremental cost of energy per the quantity of billable units, a comparison of an average customer's energy use, the environmental impacts of such use, and fuel portfolios, if applicable. The purpose of this action would be to quantify consumers' energy use and to raise their level of interest.

Policy Design

Goals:

Timing: The program begins as a voluntary program after law passes in mid 2008, and becomes mandatory on January 1, 2010. When must goals be achieved? In this case, the goal is the implementation of the program.

Parties Involved: The program covers all public and private building owners and all utility companies.

The program takes on the issue of the difference in performance based on the occupant's use. An example would be to measure on an occupant versus square footage basis or to average out a number of units.

Each utility bill would include relevant E2 and environmental impact information, such as the monthly incremental energy unit charge (less tax), and for comparison, the historical charge for the same period from the previous billing year.

The program would engage and educate consumers regarding their incremental monthly billing charges, and as an outcome, initiate sound knowledge-based energy decisions.

Implementation Mechanisms

Research is needed on best methods for getting systems in place for distributing information on commercial and residential buildings for sale or lease (i.e., the real estate industry's multiple listing service system). The capability of utilities to produce the information required also must be ensured. Eventually, more detailed information may be required to be disclosed.

Related Policies/Programs in Place

None. [*Note: Need to verify this.*]

Type(s) of GHG Reductions

Reductions from avoided fossil-fuel electricity generation and fuel combustion and consumption.

Estimated GHG Reductions and Net Costs or Cost Savings

Data Sources: Not applicable.

Quantification Methods: Not applicable.

Key Assumptions: Not applicable.

Key Uncertainties

Timing, scope of disclosure.

Additional Benefits and Costs

Public awareness and education.

Feasibility Issues

TBD

Status of Group Approval

Approved.

Level of Group Support

Unanimous consent.

Barriers to Consensus

None.

RCI-9. Promote Technology-Specific Applications To Reduce GHG Emissions

Policy Description

Promote through incentives, technology-specific applications that reduce GHG emissions. Identify the options through research, and organize them in categories, such as space heating, lighting, water heating, and plug loads. Include a process to determine and clarify which applications work best in reducing GHG emissions. Clearly communicate the fact that reducing energy use does not always proportionally reduce emissions. Consider developing disincentives to technologies that do not reduce emissions.

Emphasize producing on-site renewable energy as a technology-specific application. Clarify what is considered as renewable (e.g., solar hot water heat, photovoltaics and wind generation), as determined by current state law. Require 2% of the energy used by state-funded buildings to be on-site renewable energy. Provide incentives to owners of other public and private buildings who produce at least 2% of their required building energy on site.

Policy Design

Goals:

Timing: The program begins as a voluntary program when law passes in June 2008, and then institutes requirements and incentives on January 1, 2010. The goal is to have the program in place by 2010.

Parties Involved: The mandatory program is for state-funded building owners. Incentives and disincentives are for all other public and private building owners (residential, commercial and industrial). Research organizations should support this effort.

The program should be supplemented with research of technology-specific applications for GHG reductions.

Implementation Mechanisms

How should the program be implemented? Inform all building owners about the program, determine and fund possible private incentives, and coordinate with education and training programs similar to those established in other programs.

Related Policies/Programs in Place

An inventory all current incentives in the state needs to be conducted (including an evaluation of the current cap on requiring utility companies to buy back renewable power at the cost of purchase).

Type(s) of GHG Reductions

Reductions from avoided fossil-fuel electricity generation and energy generation.

Estimated GHG Reductions and Net Costs or Cost Savings

Data Sources: Not applicable.

Quantification Methods: Not applicable.

Key Assumptions: Not applicable.

Key Uncertainties

Timing of program and scope of coverage.

Additional Benefits and Costs

Promote local innovation.

Feasibility Issues

TBD

Status of Group Approval

Approved.

Level of Group Support

Unanimous consent.

Barriers to Consensus

None.

RCI-10. Support Strong Federal Appliance Standards and Require High State Standards in the Absence of Federal Standards

Policy Description

Appliance efficiency standards reduce the market cost of energy efficiency improvements by incorporating technological advances into base appliance models, thereby, thereby creating economies of scale. Minnesota should adopt appliance efficiency standards at the state level not covered by federal standards or where higher-than-federal standard efficiency requirements are appropriate. California has established efficiency standards for a number of appliances not currently included in national legislation, such as consumer electronics (standby power use), and general service incandescent lamps.

The specific policy approach suggested by the RCI TWG is to:

- Address existing federal appliance efficiency standards by developing a State of Minnesota Residential Appliance Efficiency Standard. (Consider adoption of the appliance efficiency standards already adopted by California.). Request that the Governor, through the National Governors Association, provide the leadership to seek the federal government's adoption of the Minnesota Residential Appliance Efficiency Standard by.
- As part of a Minnesota Residential Appliance Efficiency Standard, require that all energy-consuming appliances be labeled for average annual energy consumption (kilowatt-hours, or thermal units). The information provided in the label would be in addition to any existing Energy Star information that may already be provided for comparison purposes.
- Also as part of a Minnesota Residential Appliance Efficiency Standard, require the development of a consumer education program on appliance efficiency. Insist that all utilities and appliance retailers in the state of Minnesota provide appliance efficiency information to their customers.
- Require high-efficiency Energy Star appliances to be installed in all new residential construction and major retrofits.
- Require utilities to provide Energy Star appliance rebates where they are deemed cost-effective. (The Minnesota DOC Commissioner will determine cost-effectiveness in the CIP process.)
- Advocate for the adoption of a State of Minnesota Residential Appliance Upgrade Program. The program would require the seller of a home to establish an appliance escrow account for any of the major appliances within the home that are older than 15 years. The escrow account would only be made available to the homebuyer for upgrading the major appliances in the home to Energy Star-rated appliances.
- Where possible, require or encourage appliance manufacturers to adopt grid-friendly "smart chip" technology into their appliances that will allow utilities to communicate with smart chip appliances to curtail energy use and respond to energy pricing changes.

Policy Design

Goals:

Timing:

Parties Involved: The program covers manufacturers and retailers of appliances, builders, realtors and home sellers, and utilities.

Other:

Implementation Mechanisms

Legislation, regulation, and education and outreach.

Related Policies/Programs in Place

None.

Type(s) of GHG Reductions

Reductions from avoided fossil-fuel electricity generation.

Estimated GHG Reductions and Net Costs or Cost Savings

Data Sources:

- Population projections from the Minnesota State Demographic Center, available at: http://www.demography.state.mn.us/documents/MinnesotaPopulationProjections20052035.pdf
- National population projections from the U.S. Census Bureau, available at: http://www.census.gov/population/projections/SummaryTabA1.xls
- *Leading the Way: Continued Opportunities for New State Appliance and Equipment Efficiency Standards*, by Steven Nadel, Andrew deLaski, Jim Kleisch, and Toru Kubo, available at: http://www.standardsasap.org/documents/a051.pdf
- 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, available at: http://www.westgov.org/wga/initiatives/cdeac/Energy%20Efficiency-full.pdf
- Minnesota GHG forecast developed for this process (based on the worksheet called "Energy Use and CO_2" in a spreadsheet called GHGemitsum07_Working.xls)
- Regional fuel prices from the EIA AEO2007 estimates for the West North Central region, available at: http://www.eia.doe.gov/oiaf/aeo/supplement/
- Minnesota natural gas prices from the EIA, available at: http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_SMN_a.htm

Quantification Methods: See Annex 1.

Key Assumptions: See Annex 2.

Key Uncertainties

Scaling down of results of a national study to Minnesota conditions.

Additional Benefits and Costs

Reduced local air pollution.

Feasibility Issues

TBD

Status of Group Approval

Pending approval.

Level of Group Support

Pending approval.

Barriers to Consensus

Quantification of emission reductions and associated implementation costs.

Annex 1. Methodology for the Quantification of Energy Supply Mitigation Options

This Annex outlines key elements of the methodology used for quantifying the GHG reduction benefits and associated costs for energy supply policy options that are considered amenable to quantification. The list of topics addressed in this Annex is summarized below. Feedback from energy supply (ES) TWG members has been solicited in the finalization of this methodological approach.

A. Premises

B. Outputs

C. Methodology

D. Assumptions

E. Cost Inclusion

F. Proposed Schedule and Process

A. Premises

the analysis was to be based on a number of key premises, as briefly outlined below.

- *CCS role:* CCS has undertaken the analysis of the ES options, with input and feedback from energy supply TWG members
- *Transparency:* Data sources, methods, key assumptions, and key uncertainties are to be clearly indicated.
- *Analytical approach:* The general approach of cost-effectiveness (and net present value [NPV]) analysis was adopted, as widely applied to GHG mitigation policy options.[1] We include direct, economic costs from the perspective of the state as whole (e.g., avoided costs of electricity, rather than consumer electricity prices).
- *Bottom-up analysis:* A bottom-up approach was adopted, which is amenable to transparency and is capable of reflecting the costs (and cost savings) associated with individual policy options, in contrast to macroeconomic analysis, which aims to capture flows and interactions across all sectors of the economy. Potential macroeconomic impacts, cost, or benefits that fall disproportionately on specific groups or actors, as well external costs and benefits, should be noted qualitatively where studies or other information are available.

B. Outputs

The analysis of mitigation options was organized so as to produce the following results:

[1] See, for example, Section 2.4 of the Intergovernmental Panel on Climate Change Fourth Assessment Report, Working Group III, for more discussion of various economic analysis approaches: http://www.mnp.nl/ipcc/pages_media/AR4-chapters.html

- *Net GHG reduction potential* in million metric tons of carbon dioxide equivalents ($MMtCO_2e$) using the Intergovernmental Panel on Climate Change (IPCC) 100-year global warming potential, reported annually for the years 2015, 2020, and 2025, as cumulatively for the period 2008–2025. Where significant additional GHG reductions or costs occur beyond the project period as a direct result of actions taken during the project period, these will be indicated as appropriate.
- *NPV cost* (or cost savings) for the period 2008–2025 in 2006 constant dollars, using a 5% real discount rate.[2] Positive numbers represent options with net costs; negative numbers represent options with net cost savings.
- *Cost per $MtCO_2e$* emissions reduced (or removed) in units of dollars per $MtCO_2e$. This figure represents the NPV cost divided by the cumulative emission reductions, both over the 2008–2025 period.

C. Methodology

The analysis used simple spreadsheet modeling techniques in which assumptions were transparent and readily accessible to any TWG member for review and adjustment. To ensure consistent results across options, common factors and assumptions were used for such items as:

- *Electricity avoided costs and emissions:* Common values ($/megawatt-hour [MWh] and tCO_2/MWh) were developed based on available studies. Each mitigation option was first analyzed individually and then addressed as part of an overall integrated analysis.
- *Fuel costs and projected escalation:* Fuel cost estimates were be based on common sources, wherever possible. For example, fossil fuel price escalation was indexed to DOE's most recent projections published in AEO 2007.
- *Overlap with other TWGs:* Some RCI options overlapped with options considered in the ES TWG. The analysis for these options took place in close coordination with the assumptions and other inputs used in the ES TWG.
- *Consumption-based approach:* This approach aims to reflect the emissions associated with electricity sources used to deliver electricity to consumers in Minnesota. It is distinct from a production-basis approach, which considers the emissions from Minnesota power plants, regardless of where the electricity is delivered.
- *Full fuel-cycle approach:* Related to the previous point, a fuel-cycle analysis was applied wherever emission impacts upstream (e.g., production, extraction) or downstream (e.g., waste disposal) from a specific activity constitute a significant fraction of a policy option's total emission impacts *and* where studies were sufficient to enable estimation.

D. Assumptions

As much as possible, the analysis sought to rely on data sources that are Minnesota-specific and that TWG members were in a good position to obtain and provide. The success of this approach depended on how accessible the information was to TWG members and the timeliness in which it was provided to the CCS analysis team. Where Minnesota-specific information could not be

[2] Capital investments with lifetimes longer than 2025 are represented in terms of levelized or amortized costs to avoid "end effects."

readily obtained, the analysis relied on published data from the DOE's, National Laboratories and other state climate change processes.

E. Cost Inclusion

Several types of costs were explicitly considered in the analysis, and several others were excluded, as summarized below.

- *Examples of costs included:*
  - Capital costs, levelized (amortized) where appropriate (e.g., for new energy-efficient equipment);
  - O&M and other labor costs (or incremental costs relative to standard practice);
  - Fuel and material costs (e.g., for natural gas, electricity, biomass resources, water, fertilizer, material use, and electricity transmission and distribution); and
  - Other direct costs—administrative and other costs (where readily estimated).
- *Examples of costs excluded:*
  - External costs, such as the monetized environmental or social benefits and impacts (value of damage to structures, crops, etc., from air pollutants), quality-of-life improvements, improved road safety, or other health impacts and benefits;
  - Energy security benefits; and
  - Macroeconomic impacts related to the impacts of reduced or increased consumer spending, and shifting of cost and benefits among actors in the economy.

F. Proposed Schedule and Process

Annex 2. Key Assumptions

RCI-1: Maximize Savings From the Utility Conservation Improvement Program (CIP)

Assumed start year for the new CIP legislation

2008

Current estimates of accumulated embedded energy efficiency and conservation in 2003 (new CIP activities as a percentage of total sales):

	1
1	0.8%
2	0.5%
3	0.4%

Future program spending of the new CIP

	1
1	Future spending proportional to 2003 levels (default)
2	User-defined

Marginal resource associated with electricity savings

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

Current estimates of accumulated embedded energy efficiency and conservation in 2003 (new CIP activities as a percentage of total sales):

Estimate #	1	is the assumption used in the analysis
Estimate #1 (default)	0.8%	source: Office of the Legislative Auditor, State of Minnesota, 2005, "Evaluation Report: Energy Conservation Improvement Program", January, page 5
Estimate #2	0.5%	source: RCI TWG estimate as proposed during the TWG meeting held on 23 October 2007
Estimate #3	0.4%	source: spreadsheet attachment in an email from Peter Ciborowski to Bill Dougherty dated 26 October 2007

Current estimates of first year cost effectiveness of MN CIP

2003 expenditures by regulated utilities (million $)	$52	source: Office of the
2003 savings from utility expenditures (GWh)	325	source: Office of the
Average lifetime of measures (years)	15	
Lifetime savings from 2003 utility expenditures (GWh)	4,875	

Program spending in 2003 (2005$/MWh of sales avoided)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
All measures/sectors (nominal dollars)	168	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Levelized cost associated with 2003 program spending (2005 $/MWh of sales avoided)

projected inflation rate (2003-2005)	2.5%
real discount rate (%)	5%
Levelization period (years)	15
NPV (million 2005$/MWh)	$160
Real levelized cost (2005$/MWh)	$15.4

Levelized cost associated with future cost effectivenss of the MN CIP (2005$ per MWh of sales avoided)

Growth rate in program spending (%/yr)	0%
Most recent estimate - all costs (2005$/MWh)	$15.4

RCI-2. Improved Uniform Statewide Building Codes

Assumed start year for the new CIP legislation

2009

Assumption for improvement of the residential building code relative to the current residential building code in areas where the building code HAS BEEN adotpted and IS BEING enforced

1

1	no improvement in energy efficiency (default)		
2	User-defined		

Assumption for improvement of the residential building code relative to the current residential building code in areas where the building code has NOT been adotpted

1

1	improvement in energy efficiency of	3%	(default)
2	User-defined		

Assumption for percent of the state population covered by current residential building codes

1

1	The percent of MN's population is	85%	covered by the current building code (default)
2	User-defined		

Assumption for future enforcement of the residential building code

1

1	100% Statewide (default)
2	User-defined

Assumption for improvement of the commercial building code relative to the current commercial building code in areas where the building code HAS BEEN adotpted and IS BEING enforced

1

1	no improvement in energy efficiency (default)
2	User-defined

Assumption for improvement of the commercial building code relative to the current commercial building code in areas where the building code has NOT been adotpted

1

1	improvement in energy efficiency of	5%	(default)
2	User-defined		

Assumption for percent of the state commercial activity covered by current commercial building codes

1

1	Percent of MN's commercial sector,	85%	is covered by the current building code (default)
2	User-defined		

Assumption for future enforcement of the commercial building code

1

1	100% Statewide (default)
2	User-defined

Marginal resource associated with electricity savings

1

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

Real discount rate

1

1	Use	5%
2	User-defined	

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%

Real discount rate

	1	
1	Use	5%
2	User-defined	

4% *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 (defaul)
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

	2010					2025				
Parameter	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 captial 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 GHG Emissions

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	

RCI-7. Conservation Improvement-Type Program for Propane and Fuel Cell Efficiency

Still under development

RCI-8. Energy Performance Disclosure

Still under development

RCI-9. Promote Technology-Specific Applications To Reduce GHG Emissions

Still under development

RCI-10. Support Strong Federal Appliance Standards and Require High State Standards in the Absence of Federal Standards

Still under development