



**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-4	Incentives & Resources to Promote Combined Heat and Power (CHP)	0.96	4.95	33.1	\$125	\$3.8	Approved

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

Policy Description

Combined heat and power (CHP) systems reduce fossil fuel use and GHG emissions, both through the improved efficiency of the CHP systems, relative to separate heat and power technologies, and by avoiding transmission and distribution losses associated with moving power from central power stations that are located far away 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/expansion of markets for, and incentives designed to promote implementation of, CHP units in capacities suitable for residential, commercial, and industrial 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.
- Needs to be integrated with MCCAG Energy Sector work.

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

Policy Design

Goals: Achieve 50% of the CHP technical potential in MN

Timing: Implement changes in regulation necessary to encourage technologies by 2010

Parties Involved: Encouraging the development of combined heat and power will require coordination and cooperation among a number of different parties, including (but not limited to):

- Regulators (MN Utilities Commission, US EPA).
- Utilities.
- Other State Agencies.
- Industry Associations.
- Equipment suppliers/vendors/installers, building professionals, engineers.
- R&D Associations.

Other: not applicable

Implementation Mechanisms

Potential implementation mechanisms and supporting activities for this mitigation option include:

- Incentives to reduce first cost to a specific payback level can be coupled with requirements for new buildings. Specific implementation measures mentioned as possible for this option include tax credits, low/no interest loans, and similar financial incentives to business, industries and commercial firms to adopt CHP/distributed generation/renewables. The latter approach is especially important for small manufacturers, and could just be access to micro-loans.
- Encouragement CHP systems of 20 MW or smaller (or of equivalent mechanical power) by a rapid adoption and customer-friendly implementation of FERC Order 2006 for Standardization of Small Generator Interconnection Agreements and Procedures;
- Qualify heat use from CHP systems for existing renewable and energy efficiency incentive and loan programs;
- Allow energy service companies to sell CHP and consumer-sited distributed generation output to third party customers; and
- Facilitate governmental and non profit organizations to easily sell renewable energy credits and tax credits to the market place.
- Support for switching to less carbon-intensive energy resources (coal and oil to natural gas or biomass, electricity to solar water heating or space/process heat).
- Voluntary Emissions Targets for Industrial Operations.
- Can include CHP/distributed generation-related/renewables R&D contracts with private firms, grants and contracts with universities, Intramural R&D conducted at government labs, R&D contracts with private/public consortia.
- Can include patent protection, R&D tax credits, production subsidies or tax credits to firms bringing new CHP/distributed generation-related/renewables technologies to market, tax credits or rebates for new technology buyers, government procurement, and demonstration projects.
- Include methane capture and use in CHP systems at sewage treatment plants as a specific focus.
- Consider integration of distributed generation options with regional demand response initiatives/recommendations.

Expanded use of combined heat and power generation in Minnesota will need to be accompanied by reviews of related regulations. Such reviews could include:

- Review of net-metering policies e.g., electricity consumers who install on-site combined heat and power or, distributed generation fueled with renewable or fossil fuels. This review could consider the impact of NO_x and power factor requirements on net-metering and availability of information for small customers.

- There may be a need to consider rate issues in MN, including decoupling of utility revenues from sales and rate design, with a specific focus on the impacts of rate design on greenhouse gas emissions.

Related Policies/Programs in Place

Midwest CHP Applications Center

Type(s) of GHG Reductions

CO₂-equivalent reductions from avoided electricity production and avoided on-site fuel combustion less additional on-site CO₂-equivalent emissions from fuel used in CHP systems.

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>
- Energy Information Administration, “Assumptions to the Annual Energy Outlook 2007,” 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

Costs of new CHP units, integration into electric system, projected fuel prices; available markets for heat production, CHP potential in MN

Additional Benefits and Costs

Reduced local air pollution; lower transmission and distribution costs

Feasibility Issues

Cost-effectiveness of CHP systems dependent on price of natural gas; interconnection is an issue.

Status of Group Approval

Approved

Level of Group Support

Approved

Barriers to Consensus

Level and type of incentives

Annex 2. Key Assumptions

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	

1,800

Assumption for percentage of installed CHP by 2025

2

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

Please enter percent installed by 2025 in the next cell >>>

50%

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	