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Memo

To: Minnesota Climate Change Advisory Group

From: The Center for Climate Strategies

CC: Minnesota Department of Commerce
Minnesota Pollution Control Agency
Minnesota Technical Work Group Members

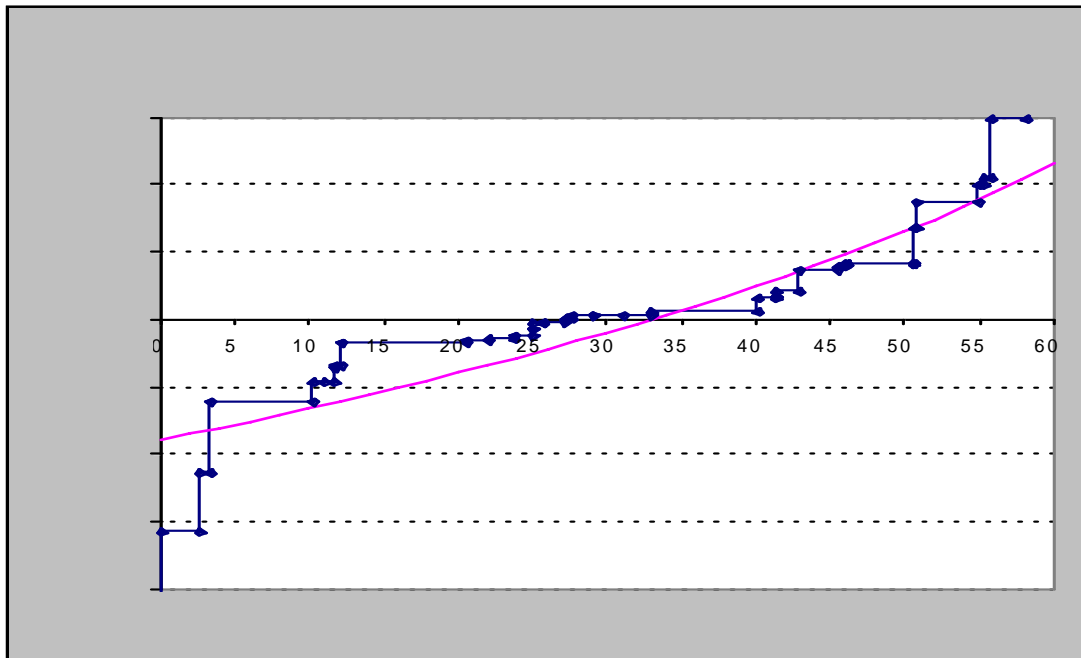
Subject: Preparation for the Seventh Meeting of the Minnesota Climate Change Advisory Group Meeting

Date: January 10, 2008

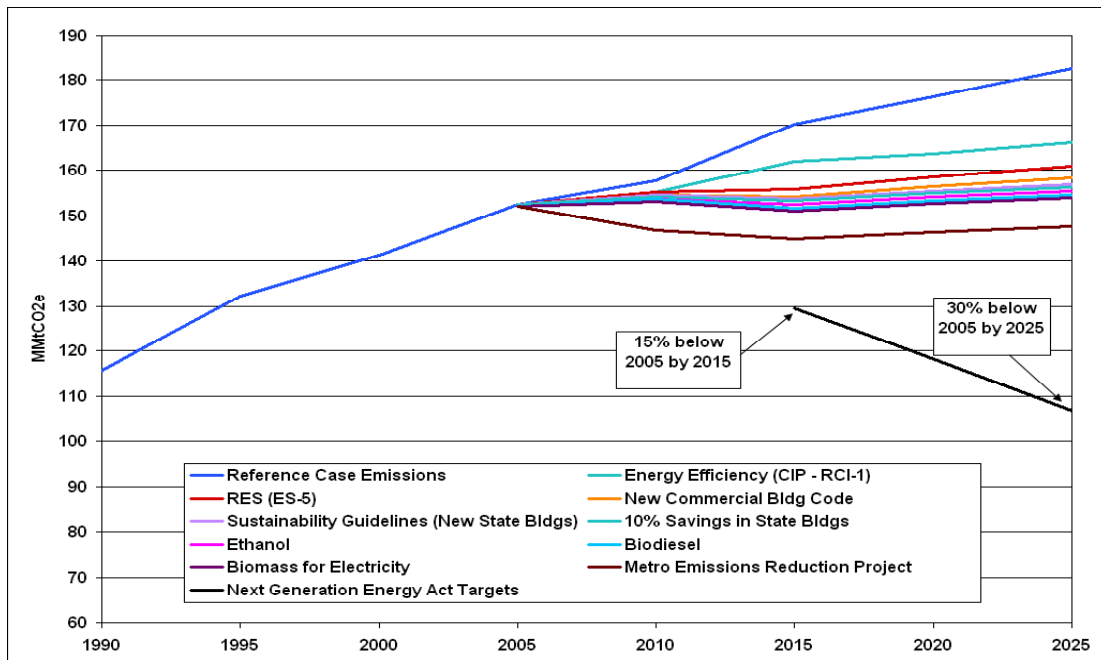
At the seventh meeting of the Minnesota Climate Change Advisory Group (MCCAG) on Thursday, January 10, 2008 the MCCAG will continue its review and final approval of draft pending policy options, with the goal of approving as many as possible in order to finish work by January 24, 2008. We also will review and approve final updates to the statewide inventory and forecast of emissions. Based on decisions made by the MCCAG, the Technical Work Groups (TWGs) will continue to update quantification and development of the remaining draft policy options that the MCCAG does not approve during this seventh meeting, as needed. Additional consideration and approval of the remaining draft options will continue at the final MCCAG meeting on January 24, 2008.

As preparation for our seventh meeting, please review the draft policy options below and other background documents posted to the project website at: www.mnclimatechange.us. Please note and review the summary of results below, as well as updates to the detailed policy options templates posted to the project website.

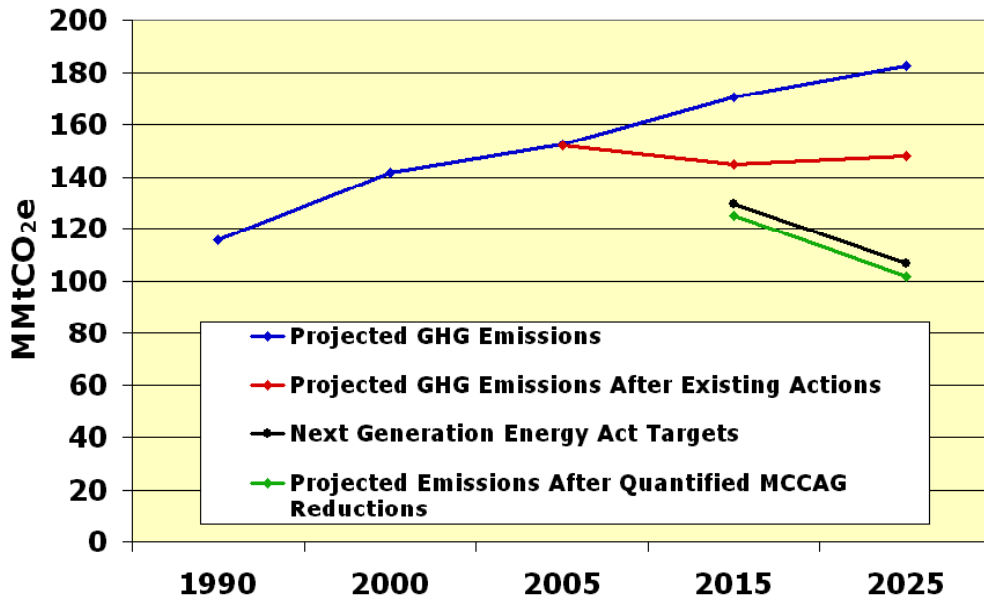
Draft MN GHG Supply Curve (Completed & Pending Options)



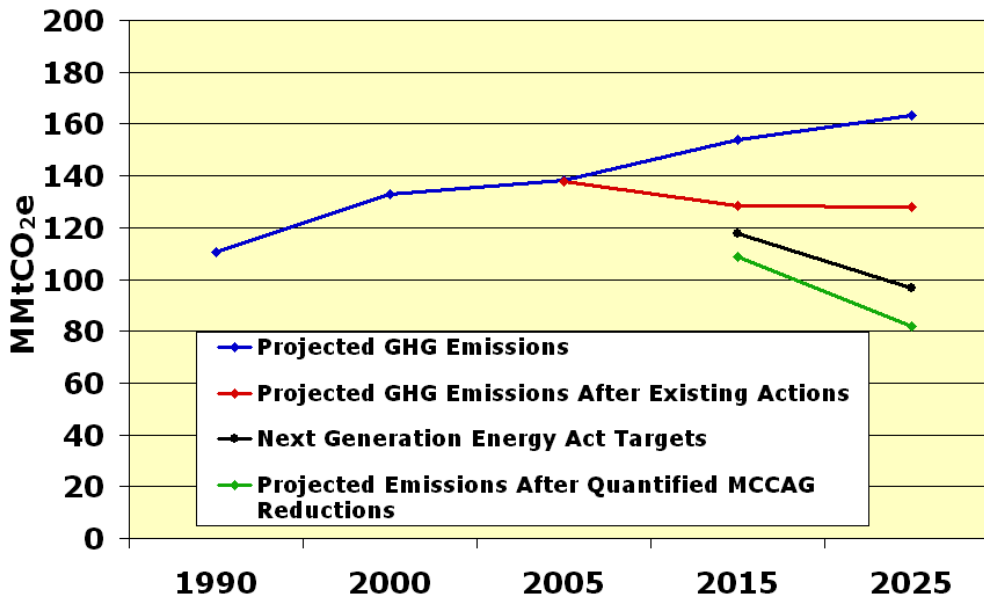
MN GHG Reductions – Existing Actions



Future Emissions - Consumption Gross



Future Emissions - Production Gross



Draft MCCAG Results

| Consumption Basis - Gross / Net Emissions | | | | | |
|---|-------------|-------------|-------------|-------------|-------------|
| | 1990 | 2000 | 2005 | 2015 | 2025 |
| Projected GHG Emissions | 115.7 | 141.4 | 152.4 | 170.2 | 182.7 |
| Reductions from Existing Actions | 0.0 | 0.4 | 0.4 | 25.4 | 35.0 |
| Projected GHG Emissions After Existing Actions | | | 152.0 | 144.8 | 147.7 |
| Next Generation Energy Act Targets (NGEA) | | | | 129.6 | 106.7 |
| Total GHG Reductions from MCCAG | | | | 19.8 | 46.2 |
| Difference Between MCCAG Reductions & NGEA Targets | | | | -4.6 | -5.3 |
| Projected Emissions After Quantified MCCAG Reductions | | | | 125.0 | 101.4 |
| Production Basis Gross / Net Emissions | | | | | |
| | 1990 | 2000 | 2005 | 2015 | 2025 |
| Projected GHG Emissions | 110.7 | 133.0 | 138.2 | 153.9 | 163.2 |
| Reductions from Existing Actions | 0.0 | 0.4 | 0.4 | 25.4 | 35.0 |
| Projected GHG Emissions After Existing Actions | | | 137.8 | 128.5 | 128.2 |
| Next Generation Energy Act Targets (NGEA) | | | | 117.5 | 96.8 |
| Total GHG Reductions from MCCAG | | | | 19.8 | 46.2 |
| Difference Between MCCAG Reductions & NGEA Targets | | | | -8.8 | -14.8 |
| Projected Emissions After Quantified MCCAG Reductions | | | | 108.7 | 81.9 |

**Table 1.
 Residential, Commercial, and Industrial
 Summary List of Draft Pending Policy Options**

| 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-1 | Maximize Savings From the Utility Conservation Improvement Program (CIP) | 5.64 | 13.10 | 122.6 | -\$5,824 | -\$48 | Complete |
| RCI-2 | Improved Uniform Statewide Building Codes | 0.004 | 0.005 | 0.1 | -\$31 | -\$402 | Complete |
| RCI-3 | Green Building Guidelines and Standards Based on Architecture 2030 | 0.62 | 0.94 | 11.1 | -\$296 | -\$27 | Complete |
| 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 | Complete |
| 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 | <i>Not quantified</i> | | | | | Complete |
| RCI-9 | Promote Technology-Specific Applications to Reduce GHG Emissions | <i>Not quantified</i> | | | | | Complete |
| 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 | |

Note: Negative numbers represent cost savings.

Table 2.
Energy Supply
Summary List of Draft Pending Policy Options

| | Policy Option | GHG Reductions (MMtCO ₂ e) | | | Net Present Value 2008–2025 (Million \$) | Cost-Effectiveness (\$/tCO ₂ e) | Level of Support |
|-------|--|---------------------------------------|-------------|-------------------|--|--|------------------|
| | | 2015 | 2025 | Total (2008–2025) | | | |
| ES-1 | Generation Performance Standard | 4 | 5 | 62 | –\$7,812 | –\$126 | Pending |
| ES-3 | Efficiency Improvements, Repowering and other Upgrades to Existing Plants | 2 | 3 | 33 | \$554 | \$17 | Pending |
| ES-4 | Transmission System Upgrading, Including Reducing Transmission Line and Distribution System Loss | 0 | 0 | 4 | –\$47 | –\$13 | Pending |
| ES-5 | Renewable and/or Environmental Portfolio Standard | 8 | 16 | 133 | –\$1,675 | –\$13 | Pending |
| ES-6 | Nuclear Power Support and Incentives | 0 | 8 | 48 | \$3,321 | \$70 | Pending |
| ES-7 | Advanced Fossil Fuel Technology Incentives, Support or Requirements | –2 | –2 | –22 | \$3,591 | –\$162 | Pending |
| ES-8 | Carbon Capture and Storage and/or Reuse Policies | 1 | 1 | 18 | \$1,536 | \$84 | Pending |
| ES-10 | Voluntary GHG targets | <i>Not quantified</i> | | | | | Pending |
| ES-12 | Distributed Renewable Energy Incentives and/or Barrier Removal | <i>Still being quantified</i> | | | | | Pending |
| ES-13 | Technology-Based Approaches, Including Research and Development, Fuel Cells, Energy Storage, Distributed Renewable Energy Technologies, etc. | <i>Not quantified</i> | | | | | Pending |
| | Sector Total After Adjusting for Overlaps | 13.3 | 31.1 | 268 | –\$2,070 | –\$7.7 | |
| | Reductions From Recent Actions | 6.9 | 6.9 | 123 | TBD | TBD | |
| | Sector Total Plus Recent Actions | 23.2 | 37.0 | 381 | TBD | TBD | |

Notes:

1. All option totals are relative to the underlying assumption that electric expansion in MN proceeds with the recently legislated Conservation Improvement Program, Renewable Energy Standard and all planned additions including the Mesaba and Big Stone 2 stations.
2. During its September 27, 2007 meeting, the MCCAG agreed to move ES-2 (Improve the GHG Profile of Biofuels and Fossil Fuels [e.g., Low Carbon Fuel Standard, Biofuel Production]) to the TLU TWG which is now being addressed under TLU-3 (Low GHG Fuel Standard).
3. See Annex 3 for details of the calculation of sector total after adjusting for overlaps.
4. Negative numbers represent cost savings.

**Table 3.
 Transportation and Land Use
 Summary List of Draft Pending Policy Options**

| | Policy Option | GHG Reductions* (MMtCO ₂ e) | | | Net Present Value 2008–2025 (Million \$) | Cost-Effectiveness (\$/tCO ₂ e) | Level of Support |
|---|---|---|------------|-----------------|--|---|------------------|
| | | 2015 | 2025 | Total 2008–2025 | | | |
| TLU Area 1: Reduce VMT | | | | | | | |
| | To 1990 Light-Duty aggregate | 2.72 | 8.12 | 66.4 | | | |
| | To 1990 Light-Duty per capita | 0.75 | 4.39 | 44.0 | | | |
| TLU-1 | Improved Land Use Planning and Development Strategies | 0.7 | 2.2 | 16.1 | Net savings | Net savings | Pending |
| TLU-2 | Expand Transit, Bicycle, and Pedestrian Infrastructure | 0.1 | 0.3 | 3.0 | \$0 | \$0 | Pending |
| TLU-5 | Climate-Friendly Transportation Pricing / Pay as You Drive | 1.2 | 2.7 | 25.8 | –\$1 | –\$1 | Pending |
| TLU-7 | “Fix-it-First” Transportation Investment Policy and Practice | Not quantified | | | | | Pending |
| TLU-9 | Workplace Tools to Encourage Carpooling, Bicycling, and Transit Ridership | 0.3 | 0.4 | 5.3 | Large net savings | Large net savings | Pending |
| TLU-14 | Freight Mode Shifts: Intermodal and Rail | TBD | | | | | Pending |
| TLU Area 2: Reduce Carbon per Unit of Fuel | | | | | | | |
| TLU-3 | Low GHG Fuel Standard (Overlap With AFW-7) | 3.18 | 4.4 | 24.3 | \$3,090 | \$119 | Pending |
| TLU Area 3: Reduce Carbon per Mile and/or per Hour | | | | | | | |
| TLU-4 | Infrastructure Management | 0.04 | 0.1 | 0.9 | Not quantified | | Pending |
| TLU-6 | Adopt California Clean Car Standards | Being revised in response to new CAFÉ | | | | | Pending |
| TLU-11 | Heavy-Duty Idle Reduction | Not quantified | | | | \$4 at \$2.40/gal –\$66 at \$3.40/gal | Pending |
| TLU-12 | Mobile Source Emissions Reduction | TBD | | | | | Pending |
| TLU-13 | Reduce Maximum Speed Limits | TBD | | | | \$50 at \$2.40/gal –\$19 at \$3.40/gal | Pending |
| Sector Total After Adjusting for Overlaps | | 5.2 | 9.6 | 71.6 | TBD | TBD | |
| Reductions From Recent Actions | | 1.6 | 1.8 | 22.6 | 0.0 | 0.0 | |
| Sector Total Plus Recent Actions | | 3.6 | 7.8 | 49.0 | TBD | TBD | |

Notes:

All GHG reduction numbers will change if the MCCAG approves the use of the new VMT baseline.
 Negative numbers represent cost savings.

**Table 4.
 Agriculture, Forestry, and Waste Management
 Summary List of Draft Pending Policy Options**

| | Policy Option | GHG Reductions (MMtCO ₂ e) | | | Net Present Value 2008–2025 (Million \$) | Cost-Effectiveness (\$/tCO ₂ e) | Level of Support |
|-------|---|---------------------------------------|-------------|-----------------|--|--|------------------|
| | | 2015 | 2025 | Total 2008–2025 | | | |
| AFW-1 | Agricultural Crop Management | | | | | | Complete |
| | A. No Till | 0.72 | 1.30 | 15 | –\$4 | –\$0.3 | |
| | B. Nutrient Management | 0.79 | 1.35 | 15 | –\$543 | –\$37 | |
| AFW-2 | Land Use Management Approaches for Protection and Enrichment of Soil Carbon | | | | | | Complete |
| | A. Preserve Land | 0.15 | 0.44 | 3.7 | \$120 | \$33 | |
| | B. Reinvest in Minnesota–Clean Energy (RIM-CE) | 0.09 | 0.19 | 1.8 | \$193 | \$110 | |
| AFW-3 | In-State Liquid Biofuels Production | | | | | | Pending |
| | A. Ethanol carbon content | 2.13 | 3.00 | 35 | \$23 | \$1 | Pending |
| | B. Fossil diesel displacement | 0.03 | 0.19 | 1.4 | \$85 | \$62 | |
| | C. Gasoline Displacement | 4.63 | 13.60 | 114 | \$563 | \$5 | |
| AFW-4 | Expanded Use of Biomass Feedstocks for Electricity, Heat, or Steam Production | 1.3 | 3.8 | 32 | \$392 | \$12 | Complete |
| AFW-5 | Forestry Management Programs to Enhance GHG Benefits | | | | | | Complete |
| | A. Forestation | 0.55 | 2.19 | 17 | \$218 | \$13 | |
| | B. Urban forestry | 1.2 | 2.7 | 26 | –\$295 | –\$12 | |
| | C. Wildfire reduction | <i>Not Quantified</i> | | | | | |
| | D. Restocking | 2.1 | 8.4 | 65 | \$2,187 | \$33 | |
| | E. Forest health and enhanced sequestration | <i>Not Quantified</i> | | | | | |
| AFW-6 | Forest Protection—Reduced Clearing and Conversion to Non-Forest Cover | 2.2 | 2.7 | 34 | \$74 | \$3 | Complete |
| AFW-7 | Integrated Waste Management | | | | | | Pending |
| | A. Source Reduction | 0 | 3.7 | 9.2 | TBD | TBD | |
| | B. Recycling | 3.1 | 4.1 | 46 | TBD | TBD | |
| | C. Composting | 0.23 | 0.24 | 4.1 | \$173 | TBD | |
| AFW-8 | End of Use Waste Management Practices | | | | | | Pending |
| | A. Landfilled Waste Methane | 0.03 | 0.34 | 2.1 | \$2.1 | \$1 | |
| | B. Organics Recovery & WTE | 0.11 | 0.07 | 1.8 | TBD | TBD | |
| | C. WTE Preprocessing | 0.002 | 0.005 | 0.04 | <i>Not Quantified</i> | | |
| | Sector Total After Adjusting for Overlaps* | 13.3 | 30.7 | 283.6 | TBD | TBD | |
| | Reductions From Recent Actions | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| | Sector Total Plus Recent Actions | 13.3 | 30.7 | 283.6 | TBD | TBD | |

Note: Negative numbers represent cost savings.

**Table 5.
 Cross-Cutting Issues
 Summary List of Draft Pending Policy Options**

| Option No. | Policy Option | GHG Reductions (MMtCO ₂ e) | | | Net Present Value 2008–2025 (Million \$) | Cost-Effectiveness (\$/tCO ₂ e) | Status of Option |
|------------|---|---------------------------------------|------|-----------------|--|--|---------------------------------|
| | | 2015 | 2025 | Total 2008-2025 | | | |
| CC-1 | GHG Inventories, Forecasting, Reporting, and Registry | <i>Not Quantified</i> | | | | | Pending |
| CC-2 | Statewide GHG Reduction Goals and Targets | <i>Not Quantified</i> | | | | | Pending |
| CC-3 | State and Local Government GHG Emissions (Lead-by-Example) | <i>Not Quantified</i> | | | | | Pending |
| CC-4 | Public Education and Outreach | <i>Not Quantified</i> | | | | | Pending |
| CC-7 | Participate in Regional and Multi-State GHG Reduction Efforts | <i>Not Quantified</i> | | | | | Pending |
| CC-8 | Encourage the Creation of a Business-Oriented Organization to Share Information and Strategies, Recognize successes, and Support Aggressive GHG Reduction Goals | <i>Not Quantified</i> | | | | | Pending |
| CC-9 | Dedicate Greater Public Investment to Climate Data and Analysis | <i>Not Quantified</i> | | | | | Pending |
| CC-10 | Facilitate the Development of an Effective Carbon Credit System for MN | <i>Not Quantified</i> | | | | | Coordinate w/ Cap and Trade TWG |
| | Sector Total After Adjusting for Overlaps | <i>Not Quantified</i> | | | | | |
| | Reductions From Recent Actions | <i>Not Quantified</i> | | | | | |
| | Sector Total Plus Recent Actions | <i>Not Quantified</i> | | | | | |

Note: Negative numbers represent cost savings.

**Table 6.
 Cap and Trade (C&T)
 Summary List of Draft Pending Policy Options**

| Option No. | Policy Option | GHG Reductions (MMtCO ₂ e) | | | Net Present Value (Million \$) | Cost-Effectiveness* (\$/tCO ₂ e) 2025 | Permit Price [†] (\$/tCO ₂ e) 2025 | Level of Support |
|--------------------------------|---|---------------------------------------|-------|-------------------|--------------------------------|--|--|------------------|
| | | 2015 | 2025 | Total (2008–2025) | | | | |
| C&T-1 Cap and Trade Program | Midwestern Governors Association (MGA) Partners C&T – <i>High Cost Case</i> (All Sectors) | | 77.24 | | | \$3.37 | \$45.68 | Pending |
| | MGA Partners C&T – <i>Low Cost Case</i> (All Sectors) | | 77.19 | | | \$1.19 | \$40.58 | Pending |
| | MGA Partners+Observers C&T – <i>High Cost Case</i> (All Sectors) | | 80.33 | | | \$5.08 | \$49.85 | Pending |
| | MGA Partners+Observers C&T – <i>Low Cost Case</i> (All Sectors) | | 80.15 | | | \$3.43 | \$44.23 | Pending |
| | MGA plus WCI Partners C&T – <i>High Cost Case</i> (All Sectors) | | 72.56 | | | \$0.85 | \$39.60 | Pending |
| | MGA plus WCI Partners C&T – <i>Low Cost Case</i> (All Sectors) | | 74.79 | | | \$0.75 | \$37.71 | Pending |
| | MGA and WCI Partners+Observers C&T – <i>High Cost Case</i> (All Sectors) | | 79.42 | | | \$4.58 | \$48.61 | Pending |
| | MGA and WCI Partners+Observers C&T – <i>Low Cost Case</i> (All Sectors) | | 81.51 | | | \$4.13 | \$45.94 | Pending |
| | MGA Partners C&T – <i>High Cost Case</i> (Power Sector) | | 22.41 | | | \$1.64 | \$32.14 | Pending |
| | MGA Partners C&T – <i>Low Cost Case</i> (Power Sector) | | 22.41 | | | \$1.22 | \$23.93 | Pending |
| | MGA Partners+Observers C&T – <i>High Cost Case</i> (Power Sector) | | 22.99 | | | \$2.43 | \$33.98 | Pending |
| | MGA Partners+Observers C&T – <i>Low Cost Case</i> (Power Sector) | | 22.99 | | | \$1.81 | \$25.30 | Pending |

| Option No. | Policy Option | GHG Reductions (MMtCO ₂ e) | | | Net Present Value (Million \$) | Cost-Effectiveness* (\$/tCO ₂ e) 2025 | Permit Price† (\$/tCO ₂ e) 2025 | Level of Support |
|------------|--|---------------------------------------|-------|-------------------|--------------------------------|--|--|------------------|
| | | 2015 | 2025 | Total (2008–2025) | | | | |
| C&T-2 | MN-Only C&T (merged into C&T-1) | | 80.83 | | | \$8.35 | \$50.10 | Pending |
| C&T-3 | National C&T (merged into C&T-1) | | | | | | | Pending |
| C&T-4 | Carbon Tax | | | | | | | Pending |
| C&T-5 | Market Advisory Group (Formerly CC-11) | | | | | | | Pending |
| C&T-6 | Regional and Multi-State GHG Reduction Efforts (Formerly CC-7) | | | | | | | Pending |
| C&T-7 | Carbon Credit System for Minnesota (Formerly CC-10) | | | | | | | Pending |

Note: Negative numbers represent cost savings.

Note: MGA C&T partners include Iowa, Illinois, Kansas, Michigan, Minnesota, Wisconsin, and Manitoba; MGA C&T observers include Indiana, Ohio, and South Dakota; WCI partners include Arizona, California, New Mexico, Oregon, Utah, Washington, British Columbia, and Manitoba; WCI observers include Colorado, Idaho, Montana, Nevada, and Wyoming. In order to run simulations including both MGA and WCI states in year 2025, we used 2020 marginal cost curves for WCI states for the year 2025. The emission cap for both MGA and WCI states (or provinces) is assumed to be 30% below the 2005 level in Year 2025.

* This represents the average cost per tCO₂e mitigated/sequestered for Minnesota.

† This represents the marginal cost of the last tCO₂e mitigated/sequestered, and applies to all states involved in a trading arrangement.

Results are subject to change. We have limited data on mitigation/sequestration options for Midwestern States. Preliminary results given here may change when better data is available.

It is anticipated that future model runs will include the following:

- All RGGI states of the Northeast
- Updated MN specific cost curves from the MCCAG process, and new cost curves for other states in the Midwest
- Cost curve modifications to address sensitivity analysis and alternate assumptions
- Other design assumption modifications based on MCCAG feedback