



**MINNESOTA**  
Climate Change  
Advisory Group



# Minnesota Climate Change Advisory Group

Cap and Trade Technical Work Group Meeting #10  
January 4, 2007

Minnesota Department of Commerce  
Minnesota Pollution Control Agency  
The Center for Climate Strategies

# Agenda

- Call to order
- Roll call of Cap-and-Trade TWG members and public
- Discuss revised POD and presentation to MCCAG on January 10, 2008
  - Request by Doug Peterson for reconsideration of specific language
- Discuss 'sensitivity simulation' results as requested in 12-21-07 call
- Discuss/decide policy recommendation regarding
  - Distribution of allowances
  - Early action incentives
- Discuss remaining PODs (time permitting)
  - C&T-4 Carbon Tax
  - C&T-5 Market Advisory Group
  - C&T-6 Participate in Regional Efforts
  - C&T-7 Carbon Credit System
- Public input and announcements
- Next meeting date, time
- Adjourn

**Other Key Design Variables:**

**Geographic Coverage:** The MCCAG recommends that geographic scope of the program be at a minimum Midwest regional, including the Partners in the MGA initiative (MN, WI, IL, KS, IA, MI and Manitoba). The MCCAG further recommends that linkages with other regional programs such as WCI and RGGI be encouraged and inter-regional program mergers be studied.

The MCCAG recommends against the creation of a Minnesota-only cap and trade program. The MCCAG found that as a general rule larger programs broaden access to lower-cost emission reductions opportunities, thereby reducing the overall cost of achieving the targeted reductions.

The MCCAG has found that Minnesota can achieve its GHG cap and trade reduction goals at lower cost through a Midwest regional approach than as a single state. The MCCAG also sees other benefits through regional action, including significantly greater overall emission reductions, a more powerful voice during deliberations on a potential national program and an early opportunity to work out these complex issues in a manner that is most supportive of the special needs of the Midwest prior to the implementation of a federal program. However, the MCCAG has also found that the implementation of a national program could be far preferable to a state or regional program. The Minnesota goal should be to work fervently toward the quick passage of an appropriate national program that would assimilate the regional effort.

The Cap and Trade TWG studied a Minnesota-only program, consistent with the requirements of Subd. 5(b) of Minnesota Statute 216H.02. Modeling indicates that the cost of CO<sub>2</sub> emission reductions sufficient to meet the state goals across all economic sectors under a Minnesota-only cap and trade program in 2025 compares unfavorably with all regional programs studied.

The Cap and Trade TWG is also examining the impact of a likely national program on Minnesota, pursuant to the requirements of statute.

**Sectors and Sources Covered:** The MCCAG recommends that the electric power sector, large industrial boilers and processes, transportation fuels and landfills be included in the cap and trade program. The Cap and Trade TWG also favors the inclusion of municipal waste incinerators and fossil fuel for residential and commercial use, however at least one member strongly objects to the inclusion of natural gas for residential and commercial use. The TWG is still considering whether large livestock operations (CAFOs) ought to be included in the program.

Information provided by the PCA indicates that the 700 currently-regulated stationary sources in the power generation, industrial and commercial sectors release approximately 54 million tons of CO<sub>2</sub> annually. Within these sectors the electric power (41.5M tons) and industrial (11M tons) sectors are by far the largest contributors. But across all three sectors the largest ten percent of all sources – 70 facilities – release approximately 95 percent of the total emissions. The annual emissions threshold above which these 70 facilities operate is 44,000 tons per year. If fossil fuels are part of the program as proposed by the TWG, the remaining 630 regulated sources and all unregulated sources would also be included indirectly.

A cap-and-trade program that limited and reduced emissions from the recommended sectors could make substantial progress toward achieving the state's goal. In addition, the scope of coverage of a cap and trade program is substantially affected by the level of existing and future

# Overview

This week, we present sensitivity simulations assuming RPS (Renewable Portfolio Standard) and CIP (Conservation Improvement Program) are included in the 2025 BAU emission projection for Minnesota. When we assume that RPS and CIP are already factored in the BAU case, their corresponding policy options are excluded from the option list to develop the MN marginal cost curve. The two options that are removed from the list are: 1) Maximize Savings from the Utility Conservation Improvement Program and 2) Renewable and/or Environmental Portfolio Standard. The sensitivity simulations are run for both the multi-state case and the MN-only case. We did not change the 2025 BAU emission projections or the marginal cost curves of other states in the sensitivity simulations.

- The multi-state simulations include the following geographical configurations: 1) MGA partner states, 2) MGA partner states and observer states, 3) MGA and WCI partner states, and 4) MGA and WCI partner plus observer states. For each geographical configuration, we ran high-cost and low-cost cases.
- 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. We also assumed that the same emission cap in year 2025 (30% below the 2005 level) for MGA states applies to WCI states as well.
- The MN-only sensitivity run covers the same four sectors as the run of the December 21 call: 1) Power Sector; 2) Transportation Sector; 3) Sequestration Sector; and 4) Other Sector.

# Interpretation of Results (1)

- When RPS and CIP are included in the Minnesota 2025 BAU emission projection, the projected emission level decreases from 187.5 MMTCO<sub>2</sub>e to 163.9 MMTCO<sub>2</sub>e. The emission reduction requirement in 2025 reduces from 43.10% of the BAU level to 34.88% in order to meet the same cap of 30% below the 2005 level. On the other hand, the mitigation options of RPS and CIP are removed from the policy option list that is used to develop the marginal cost curve. This results in an upward shift of the MN marginal cost curve. The simulation results show that the effects of the lower emission reduction goal relative to the BAU level and the steeper cost curve nearly offset each other. For example, the permit prices in the simulations with RPS and CIP in the BAU condition are less than one dollar lower than the corresponding simulation cases without RPS and CIP in the baseline.

# Interpretation of Results (2)

- Similar to the previous runs, the permit price is lowest for the case of trading among MGA and WCI partners than in various other configurations. Including the MGA observers or the WCI observers will increase the permit price. These results indicate that: 1) on average the MGA observers have higher mitigation costs compared with the MGA partners and 2) MGA partner states have overall higher mitigation/sequestration costs than the WCI partners, but lower costs than the WCI partners plus observers. As a permit buyer, Minnesota would be better off joining the WCI trading market with only the eight partners, because it can buy permits at a lower price than in other configurations.

# Interpretation of Results (3)

- In the cases where the observer states are included, Minnesota becomes a permit seller since the equilibrium permit price is slightly higher than the state's marginal cost level to accomplish the reduction goal on its own. However, the amount of permits MN sells in the market is small--less than 1 MMtCO<sub>2</sub>e.
- The positions in terms of permit buyers or sellers of other states did not change in the sensitivity simulations.

# Interpretation of Results (4)

- In the MN-only sensitivity simulation, the model was run for trading among four major sectors within Minnesota. Including RPS and CIP in the baseline would affect the emission projection and mitigation cost curve of power sector. Similar to the multi-state runs, the effects of changes in the emission projection and the cost curve nearly offset each other. As in previous simulations, the results show that the Power Sector and Other Sector will buy permits from the Transportation Sector and Sequestration Sector. Please note that we are still unable to separate the industrial sector from the Other Sector, since the options list we are now using to generate cost curves, provides only five quantified RCI options, and because the reduction and cost data are aggregated for the whole RCI sector.

# Midwestern Partners -- High Cost Case Draft (All Sectors)

TABLE M1-2025' (High). ECONOMY-WIDE EMISSION TRADING SIMULATION AMONG SIX MIDWESTERN STATES PLUS MANITOBA IN YEAR 2025 (assuming RPS & CIP in baseline)

(million dollars or otherwise specified)

State	Before Trading	After Trading			Cost Saving	Permits Traded	Emission Reduction w/ Trading		Emission Reduction Goal
	Mitigation Cost	Mitigation Cost	Trading Cost	Net Cost		(million tCO <sub>2</sub> )	(million tCO <sub>2</sub> )	(percent from BAU)	(percent from BAU)
IA	407	-43	368	326	81	8.15	46.22	37.11	43.65
IL	35	721	-790	-70	105	-17.49	139.56	43.65	38.18
KS	529	-319	578	259	270	12.79	39.42	32.96	43.65
MI	37	208	-178	30	7	-3.94	107.25	39.64	38.18
MN	377	299	76	375	2	1.69	55.47	33.85	34.88
WI	20	225	-223	2	18	-4.93	66.72	41.23	38.18
MB	214	-48	169	120	93	3.73	9.42	34.40	48.04
Total	1,619	1,042	0	1,042	577	26.36 <sup>b</sup>	464.06	39.08	39.08

<sup>a</sup> Permit Price = \$45.20/tonCO<sub>2</sub>e. This is the price of the last permit sold, which is also equal to the price of the last ton of CO<sub>2</sub>e mitigated (its *marginal* mitigation cost). It is the same for each state for a given case. The *average* mitigation cost per unit of CO<sub>2</sub> equivalent in this simulation differs for each state. For MN, for example, it is \$5.39/tonCO<sub>2</sub>e. Please note that the average mitigation cost is related to mitigation level of a state, which for this case is 33.85% below the baseline level in 2025 for MN. Multiplying the average mitigation cost by the number of tons of CO<sub>2</sub> mitigated will equal the *total* mitigation cost for each state.

<sup>b</sup> Represents number of permits bought or sold.

# Midwestern Partners -- Low Cost Case Draft (All Sectors)

TABLE M1-2025' (Low). ECONOMY-WIDE EMISSION TRADING SIMULATION AMONG SIX MIDWESTERN STATES PLUS MANITOBA IN YEAR 2025 (assuming RPS & CIP in baseline)  
(million dollars or otherwise specified)

State	Before Trading	After Trading			Cost Saving	Permits Traded	Emission Reduction w/ Trading		Emission Reduction Goal
	Mitigation Cost	Mitigation Cost	Trading Cost	Net Cost		(million tCO <sub>2</sub> )	(million tCO <sub>2</sub> )	(percent from BAU)	(percent from BAU)
IA	295	-103	325	221	74	8.12	46.25	37.13	43.65
IL	-87	499	-675	-176	89	-16.90	138.97	43.46	38.18
KS	383	-359	503	144	239	12.59	39.61	33.12	43.65
MI	-91	53	-151	-98	6	-3.78	107.09	39.58	38.18
MN	260	219	40	259	1	1.01	56.15	34.26	34.88
WI	-50	124	-190	-65	15	-4.75	66.54	41.11	38.18
MB	173	-59	148	89	84	3.70	9.45	34.52	48.04
Total	883	374	0	374	509	25.42 <sup>b</sup>	464.06	39.08	39.08

<sup>a</sup> Permit Price = \$39.97/tonCO<sub>2</sub>e. This is the price of the last permit sold, which is also equal to the price of the last ton of CO<sub>2</sub>e mitigated (its *marginal* mitigation cost). It is the same for each state for a given case. The *average* mitigation cost per unit of CO<sub>2</sub> equivalent in this simulation differs for each state. For MN, for example, it is \$3.90/tonCO<sub>2</sub>e. Please note that the average mitigation cost is related to mitigation level of a state, which for this case is 34.26% below the baseline level in 2025 for MN. Multiplying the average mitigation cost by the number of tons of CO<sub>2</sub> mitigated will equal the *total* mitigation cost for each state.

<sup>b</sup> Represents number of permits bought or sold.

# Midwestern Partners+Observers – High Cost Case (All Sectors)

TABLE M2-2025' (High). ECONOMY-WIDE EMISSION TRADING SIMULATION AMONG NINE MIDWESTERN STATES PLUS MANITOBA IN YEAR 2025 (assuming RPS & CIP in baseline)

(million dollars or otherwise specified)

State	Before Trading	After Trading <sup>a</sup>			Cost Saving	Permits Traded	Emission Reduction After Trading		Emission Reduction Cap
	Mitigation Cost	Mitigation Cost	Trading Cost	Net Cost		(million tCO <sub>2</sub> e)	(million tCO <sub>2</sub> e)	(percent from BAU)	(percent from BAU)
IA	407	45	313	358	49	6.30	48.07	38.59	43.65
IL	35	1,011	-1,172	-160	196	-23.61	145.69	45.57	38.18
KS	529	-252	565	312	216	11.38	40.82	34.13	43.65
MI	37	421	-419	2	35	-8.44	111.74	41.30	38.18
MN	377	423	-46	377	1	-0.93	58.09	35.45	34.88
WI	20	360	-386	-26	46	-7.79	69.58	42.99	38.18
MB	214	-32	168	136	78	3.38	9.77	35.69	48.04
IN	65	-570	559	-11	76	11.27	108.15	34.58	38.18
OH	67	-102	164	62	5	3.31	143.77	37.32	38.18
SD	271	-96	254	158	113	5.12	15.92	34.20	45.20
Total	2,022	1,208	0	1,208	815	40.77 <sup>b</sup>	751.60	38.90	38.90

<sup>a</sup> Permit Price = \$49.61/tonCO<sub>2</sub>e. This is the price of the last permit sold, which is also equal to the price of the last ton of CO<sub>2</sub>e mitigated (its *marginal* mitigation cost). It is the same for each state for a given case. The *average* mitigation cost per unit of CO<sub>2</sub> equivalent in this simulation differs for each state. For MN, for example, it is \$7.28/tonCO<sub>2</sub>e. Please note that the average mitigation cost is related to mitigation level of a state, which for this case is 35.45% below the baseline level in 2025 for MN. Multiplying the average mitigation cost by the number of tons of CO<sub>2</sub> mitigated will equal the *total* mitigation cost for each state.

<sup>b</sup> Represents number of permits bought or sold.

# Midwestern Partners+Observers – Low Cost Case (All Sectors)

TABLE M2-2025' (Low). ECONOMY-WIDE EMISSION TRADING SIMULATION AMONG NINE MIDWESTERN STATES PLUS MANITOBA IN YEAR 2025 (assuming RPS & CIP in baseline)

(million dollars or otherwise specified)

State	Before Trading	After Trading <sup>a</sup>			Cost Saving	Permits Traded	Emission Reduction After Trading		Emission Reduction Cap
	Mitigation Cost	Mitigation Cost	Trading Cost	Net Cost		(million tCO <sub>2</sub> e)	(million tCO <sub>2</sub> e)	(percent from BAU)	(percent from BAU)
IA	295	-28	278	250	45	6.33	48.05	38.57	43.65
IL	-87	749	-1,004	-254	167	-22.87	144.94	45.33	38.18
KS	383	-302	493	191	193	11.23	40.97	34.26	43.65
MI	-91	236	-358	-121	30	-8.15	111.46	41.19	38.18
MN	260	328	-70	258	2	-1.59	58.74	35.85	34.88
WI	-50	241	-331	-90	39	-7.53	69.33	42.83	38.18
MB	173	-45	147	103	70	3.36	9.79	35.76	48.04
IN	-162	-706	479	-227	66	10.92	108.50	34.69	38.18
OH	-165	-311	142	-169	4	3.23	143.84	37.34	38.18
SD	208	-116	222	106	101	5.07	15.98	34.32	45.20
Total	764	47	0	47	717	40.14 <sup>b</sup>	751.60	38.90	38.90

<sup>a</sup> Permit Price = \$43.88/tonCO<sub>2</sub>e. This is the price of the last permit sold, which is also equal to the price of the last ton of CO<sub>2</sub>e mitigated (its *marginal* mitigation cost). It is the same for each state for a given case. The *average* mitigation cost per unit of CO<sub>2</sub> equivalent in this simulation differs for each state. For MN, for example, it is \$5.58/tonCO<sub>2</sub>e. Please note that the average mitigation cost is related to mitigation level of a state, which for this case is 35.85% below the baseline level in 2025 for MN. Multiplying the average mitigation cost by the number of tons of CO<sub>2</sub> mitigated will equal the *total* mitigation cost for each state.

<sup>b</sup> Represents number of permits bought or sold.

# Midwestern and WCI Partners – High Cost Case (All Sectors)

TABLE M1W1-2025' (High). ECONOMY-WIDE EMISSION TRADING SIMULATION AMONG SIX MIDWESTERN STATES, SIX WESTERN STATES, AND TWO CANADIAN PROVINCES IN YEAR 2025 (assuming RPS & CIP in baseline)

(million dollars or otherwise specified)

State	Before Trading	After Trading <sup>a</sup>			Cost Saving	Permits Traded (million tCO <sub>2</sub> e)	Emission Reduction After Trading		Emission Reduction Cap (percent from BAU)
	Mitigation Cost	Mitigation Cost	Trading Cost	Net Cost			(million tCO <sub>2</sub> e)	(percent from BAU)	
AZ	133	-1,409	1,005	-404	538	25.54	93.90	49.60	63.09
CA	947	4,123	-4,261	-138	1,085	-108.31	410.23	63.47	46.71
NM	853	-295	640	346	507	16.28	31.77	31.94	48.30
OR	260	423	-180	243	17	-4.57	50.11	54.02	49.10
UT	903	169	539	708	195	13.71	45.51	42.37	55.14
WA	2,574	-866	1,138	272	2,302	28.93	30.46	24.37	47.51
BC	158	102	53	156	2	1.36	33.52	41.41	43.09
IA	407	-149	420	271	136	10.68	43.70	35.08	43.65
IL	35	363	-354	8	27	-9.01	131.08	41.00	38.18
KS	529	-399	578	179	350	14.69	37.52	31.37	43.65
MI	37	-53	87	35	2	2.22	101.09	37.36	38.18
MN	377	147	207	355	23	5.27	51.89	31.66	34.88
WI	20	59	-39	20	1	-1.00	62.79	38.80	38.18
MB	214	-68	166	97	117	4.21	8.94	32.66	48.04
Total	7,447	2,145	0	2,145	5,301	122.89 <sup>b</sup>	1,132.49	44.78	44.78

<sup>a</sup> Permit Price = \$39.34/tonCO<sub>2</sub>e. This is the price of the last permit sold, which is also equal to the price of the last ton of CO<sub>2</sub>e mitigated (its *marginal* mitigation cost). It is the same for each state for a given case. The *average* mitigation cost per unit of CO<sub>2</sub> equivalent in this simulation differs for each state. For MN, for example, it is \$2.84/tonCO<sub>2</sub>e. Please note that the average mitigation cost is related to mitigation level of a state, which for this case is 31.66% below the baseline level in 2025 for MN. Multiplying the average mitigation cost by the number of tons of CO<sub>2</sub> mitigated will equal the *total* mitigation cost for each state.

<sup>b</sup> Represents number of permits bought or sold.

# Midwestern and WCI Partners – Low Cost Case (All Sectors)

TABLE M1W1-2025' (Low). ECONOMY-WIDE EMISSION TRADING SIMULATION AMONG SIX MIDWESTERN STATES, SIX WESTERN STATES, AND TWO CANADIAN PROVINCES IN YEAR 2025 (assuming RPS & CIP in baseline)

(million dollars or otherwise specified)

State	Before Trading	After Trading <sup>a</sup>			Cost Saving	Permits Traded	Emission Reduction After Trading		Emission Reduction Cap
	Mitigation Cost	Mitigation Cost	Trading Cost	Net Cost		(million tCO <sub>2</sub> e)	(million tCO <sub>2</sub> e)	(percent from BAU)	(percent from BAU)
AZ	133	-1,458	1,004	-454	588	26.83	92.61	48.92	63.09
CA	947	3,769	-3,710	60	887	-99.11	401.02	62.04	46.71
NM	853	-316	630	314	539	16.83	31.22	31.39	48.30
OR	260	378	-127	250	9	-3.40	48.94	52.76	49.10
UT	903	130	551	681	222	14.72	44.50	41.44	55.14
WA	2,574	-881	1,097	216	2,357	29.32	30.07	24.05	47.51
BC	158	74	78	152	6	2.09	32.79	40.51	43.09
IA	295	-149	348	199	96	9.31	45.07	36.18	43.65
IL	-87	345	-484	-139	51	-12.92	134.99	42.22	38.18
KS	383	-394	505	111	272	13.48	38.72	32.38	43.65
MI	-91	-59	-33	-92	0	-0.89	104.19	38.51	38.18
MN	260	153	102	255	5	2.72	54.43	33.22	34.88
WI	-50	53	-109	-56	6	-2.91	64.70	39.98	38.18
MB	173	-68	147	79	94	3.93	9.22	33.70	48.04
Total	6,710	1,577	0	1,577	5,133	119.22 <sup>b</sup>	1,132.49	44.78	44.78

<sup>a</sup> Permit Price = \$37.43/tonCO<sub>2</sub>e. This is the price of the last permit sold, which is also equal to the price of the last ton of CO<sub>2</sub>e mitigated (its *marginal* mitigation cost). It is the same for each state for a given case. The *average* mitigation cost per unit of CO<sub>2</sub> equivalent in this simulation differs for each state. For MN, for example, it is \$2.81/tonCO<sub>2</sub>e. Please note that the average mitigation cost is related to mitigation level of a state, which for this case is 33.22% below the baseline level in 2025 for MN. Multiplying the average mitigation cost by the number of tons of CO<sub>2</sub> mitigated will equal the *total* mitigation cost for each state.

<sup>b</sup> Represents number of permits bought or sold.

# Midwestern and WCI Partners+Observers – High Cost Case (All Sectors)

TABLE M2W2-2025<sup>1</sup> (High). ECONOMY-WIDE EMISSION TRADING SIMULATION AMONG NINE MIDWESTERN STATES, ELEVEN WESTERN STATES, AND TWO CANADIAN PROVINCES IN YEAR 2025 (assuming RPS & CIP in baseline)

(million dollars or otherwise specified)

State	Before Trading	After Trading <sup>a</sup>			Cost Saving	Permits Traded	Emission Reduction After Trading		Emission Reduction Cap
	Mitigation Cost	Mitigation Cost	Trading Cost	Net Cost		(million tCO <sub>2</sub> e)	(million tCO <sub>2</sub> e)	(percent from BAU)	(percent from BAU)
AZ	133	-1,149	951	-198	331	19.61	99.83	52.73	63.09
CA	947	5,853	-7,170	-1,316	2,263	-147.85	449.76	69.58	46.71
NM	853	-183	665	483	370	13.72	34.33	34.51	48.30
OR	260	650	-473	177	83	-9.76	55.30	59.62	49.10
UT	903	370	442	812	91	9.11	50.11	46.66	55.14
WA	2,574	-785	1,313	528	2,045	27.08	32.30	25.84	47.51
BC	158	249	-97	153	6	-2.00	36.88	45.56	43.09
CO	8,996	-1,615	2,924	1,310	7,686	60.31	51.15	28.05	61.12
ID	86	196	-125	71	14	-2.58	22.85	49.09	43.55
MT	-167	-17	-220	-237	70	-4.53	16.44	39.67	28.75
NV	948	517	366	883	66	7.54	47.63	55.64	64.45
WY	2,662	-621	1,064	443	2,219	21.94	21.81	27.97	56.12
IA	407	22	328	350	57	6.77	47.61	38.22	43.65
IL	35	936	-1,071	-135	170	-22.08	144.15	45.08	38.18
KS	529	-270	569	299	229	11.74	40.47	33.84	43.65
MI	37	365	-354	11	26	-7.31	110.61	40.88	38.18
MN	377	391	-13	377	0	-0.27	57.43	35.05	34.88
WI	20	325	-343	-18	38	-7.07	68.86	42.55	38.18
MB	214	-36	168	132	81	3.47	9.68	35.36	48.04
IN	65	-617	593	-24	90	12.22	107.20	34.27	38.18
OH	67	-169	226	58	9	4.67	142.41	36.97	38.18
SD	271	-103	255	152	119	5.26	15.79	33.90	45.20
Total	20,375	4,312	0	4,312	16,063	203.43 <sup>b</sup>	1,662.60	44.85	44.85

<sup>a</sup> Permit Price = \$48.49/tonCO<sub>2</sub>e. This is the price of the last permit sold, which is also equal to the price of the last ton of CO<sub>2</sub>e mitigated (its *marginal* mitigation cost). It is the same for each state for a given case. The *average* mitigation cost per unit of CO<sub>2</sub> equivalent in this simulation differs for each state. For MN, for example, it is \$6.80/tonCO<sub>2</sub>e. Please note that the average mitigation cost is related to mitigation level of a state, which for this case is 35.05% below the baseline level in 2020 for MN. Multiplying the average mitigation cost by the number of tons of CO<sub>2</sub> mitigated will equal the *total* mitigation cost for each state.

<sup>b</sup> Represents number of permits bought or sold.

# Midwestern and WCI Partners+Observers – Low Cost Case (All Sectors)

TABLE M2W2-2025' (Low). ECONOMY-WIDE EMISSION TRADING SIMULATION AMONG NINE MIDWESTERN STATES, ELEVEN WESTERN STATES, AND TWO CANADIAN PROVINCES IN YEAR 2025 (assuming RPS & CIP in baseline)

(million dollars or otherwise specified)

State	Before Trading	After Trading <sup>a</sup>			Cost Saving	Permits Traded (million tCO <sub>2</sub> e)	Emission Reduction After Trading		Emission Reduction Cap (percent from BAU)
	Mitigation Cost	Mitigation Cost	Trading Cost	Net Cost			(million tCO <sub>2</sub> e)	(percent from BAU)	
AZ	133	-1,229	976	-253	387	21.32	98.12	51.83	63.09
CA	947	5,338	-6,269	-931	1,878	-136.92	438.83	67.89	46.71
NM	853	-218	662	445	408	14.47	33.58	33.76	48.30
OR	260	581	-380	201	58	-8.29	53.84	58.04	49.10
UT	903	308	478	786	117	10.43	48.79	45.43	55.14
WA	2,574	-811	1,265	454	2,119	27.62	31.76	25.41	47.51
BC	158	204	-47	157	1	-1.03	35.91	44.36	43.09
CO	8,996	-1,651	2,797	1,146	7,850	61.08	50.38	27.63	61.12
ID	86	167	-90	77	8	-1.97	22.24	47.78	43.55
MT	-167	-35	-190	-225	58	-4.15	16.06	38.77	28.75
NV	948	457	404	860	88	8.82	46.36	54.15	64.45
WY	2,662	-637	1,020	383	2,279	22.28	21.46	27.54	56.12
IA	295	10	250	261	34	5.47	48.91	39.26	43.65
IL	-87	876	-1,177	-301	214	-25.70	147.78	46.22	38.18
KS	383	-273	484	211	172	10.58	41.63	34.80	43.65
MI	-91	330	-468	-139	47	-10.23	113.54	41.96	38.18
MN	260	383	-129	254	6	-2.82	59.98	36.60	34.88
WI	-50	300	-405	-105	55	-8.85	70.65	43.65	38.18
MB	173	-37	146	109	64	3.20	9.95	36.36	48.04
IN	-162	-628	420	-208	47	9.16	110.26	35.25	38.18
OH	-165	-198	34	-165	0	0.73	146.34	37.99	38.18
SD	208	-104	220	116	92	4.81	16.24	34.87	45.20
Total	19,117	3,134	0	3,134	15,983	199.98 <sup>b</sup>	1,662.60	44.85	44.85

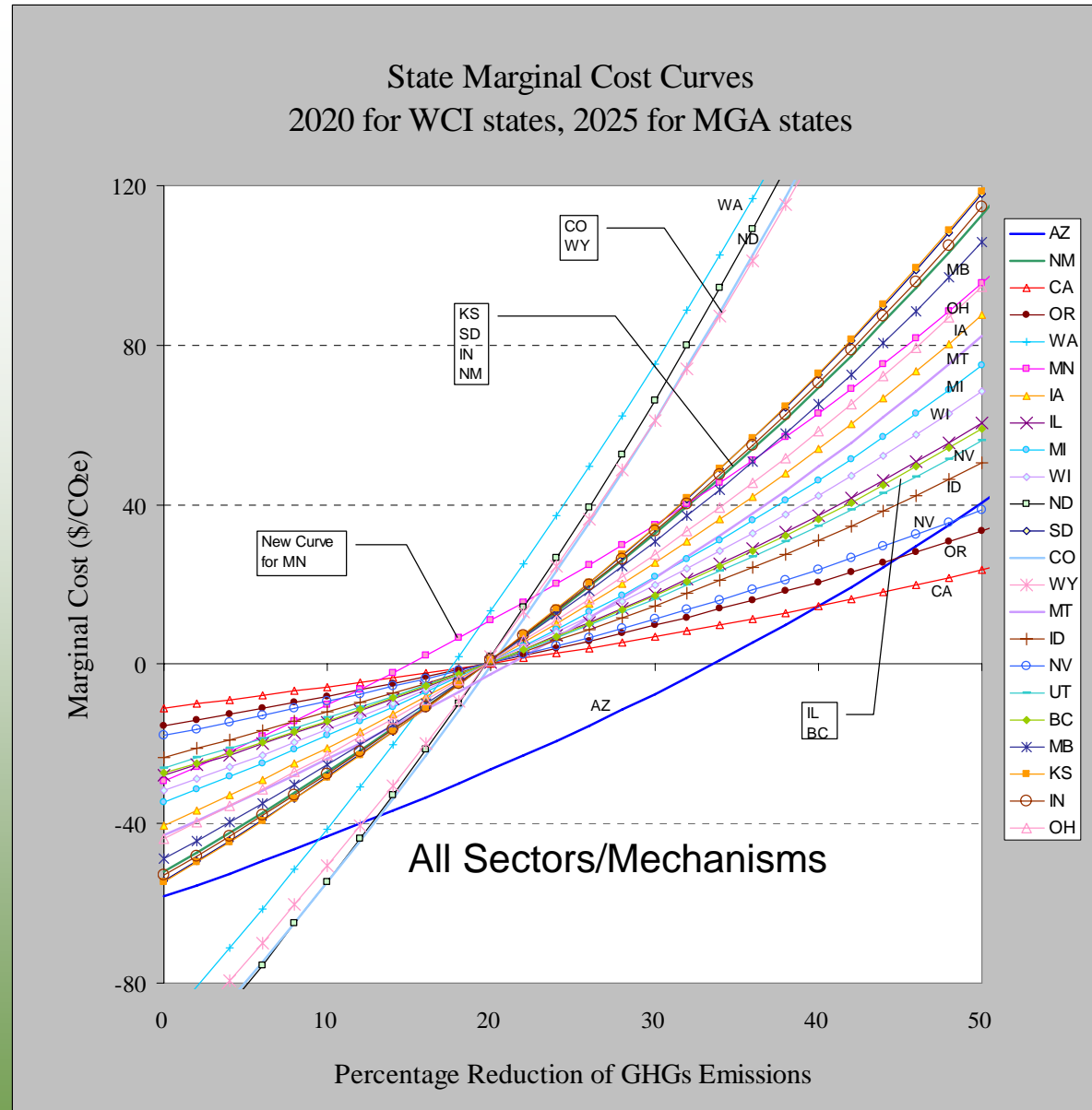
<sup>a</sup> Permit Price = \$45.79/tonCO<sub>2</sub>e. This is the price of the last permit sold, which is also equal to the price of the last ton of CO<sub>2</sub>e mitigated (its *marginal* mitigation cost). It is the same for each state for a given case. The *average* mitigation cost per unit of CO<sub>2</sub> equivalent in this simulation differs for each state. For MN, for example, it is \$6.39/tonCO<sub>2</sub>e. Please note that the average mitigation cost is related to mitigation level of a state, which for this case is 36.60% below the baseline level in 2020 for MN. Multiplying the average mitigation cost by the number of tons of CO<sub>2</sub> mitigated will equal the *total* mitigation cost for each state.

<sup>b</sup> Represents number of permits bought or sold.

# Summary Data Table -- All Sectors Draft

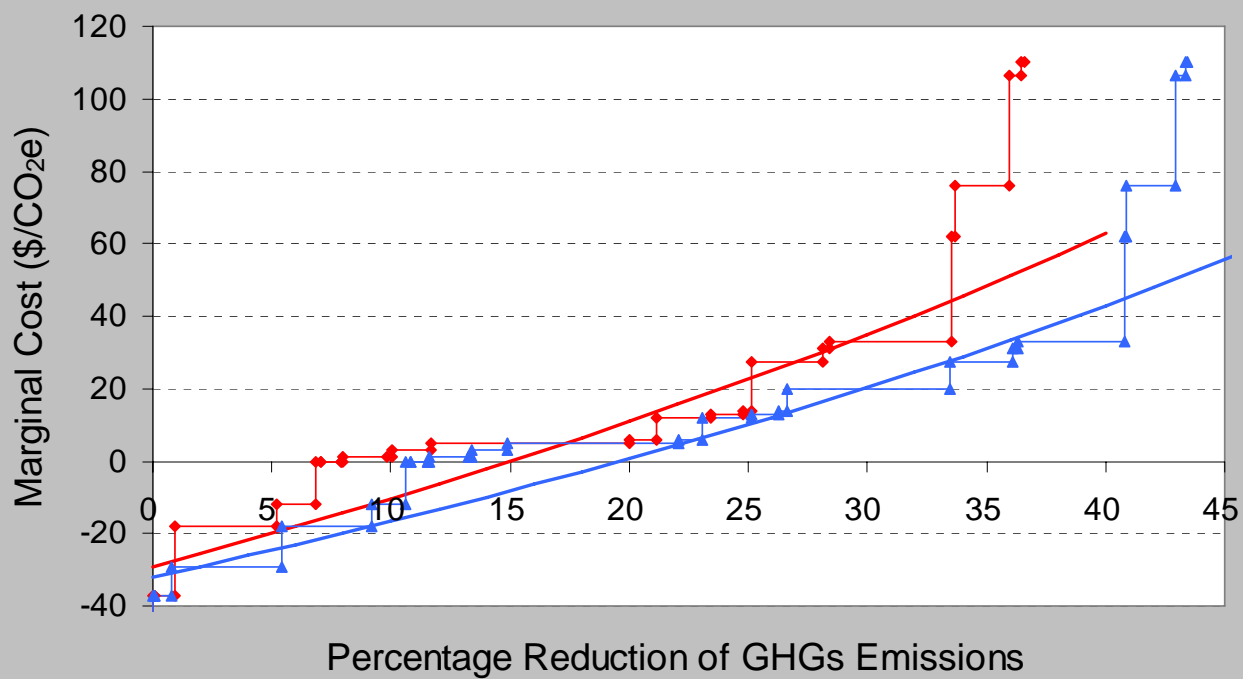
DATA TABLE

State	Cap: 30% Below 2005 Emissions in 2025 (million tCO <sub>2</sub> e)	2025 BAU Gross Emissions (Consumption- based) (million tCO <sub>2</sub> e)	GHG Mitigation Goal in 2025 (relative to BAU emissions)	Autarkic Marginal Mitigation Cost (dollars per tCO <sub>2</sub> e)		Gross State Product in 2025 (million 2000 dollars)
				Low	High	
AZ	69.9	189.3	63.09%	83.7	83.7	481,628
CA	344.4	646.4	46.71%	20.5	20.5	2,923,222
NM	51.4	99.5	48.30%	104.7	104.7	94,564
OR	47.2	92.8	49.10%	32.2	32.2	297,081
UT	48.2	107.4	55.14%	69.0	69.0	204,725
WA	65.6	125.0	47.51%	208.8	208.8	471,781
BC	46.1	81.0	43.09%	43.0	43.0	146,610
CO	70.9	182.4	61.12%	332.3	332.3	563,455
ID	26.3	46.5	43.55%	37.5	37.5	98,835
MT	29.5	41.4	28.75%	18.4	18.4	41,520
NV	30.4	85.6	64.45%	66.6	66.6	236,707
WY	34.2	78.0	56.12%	268.9	268.9	39,577
IA	70.2	124.6	43.65%	58.5	65.5	206,621
IL	197.7	319.7	38.18%	29.6	33.4	768,315
KS	67.4	119.6	43.65%	79.1	88.6	146,593
MI	167.3	270.6	38.18%	36.7	41.4	524,088
MN	106.7	163.9	34.88%	41.5	48.0	392,084
WI	100.1	161.9	38.18%	33.5	37.9	342,743
MB	14.2	27.4	48.04%	87.1	97.2	37,581
IN	193.4	312.8	38.18%	56.0	63.3	396,501
OH	238.1	385.2	38.18%	46.4	52.4	590,200
SD	25.5	46.6	45.20%	85.1	95.1	57,361
Total	2,044.7	3,707.3	44.85%			9,061,793



Note: Marginal cost curves of Midwestern states are developed based on MN 2025 curve. These curves are for the high cost scenario. The relative positions of state curves for the low cost scenario are the same, except all the curves shift downward slightly. Marginal cost curves of WCI states other than for AZ, CO, MT and WA are developed based on NM curve. These marginal cost curves are presented for a range of mitigation levels, including those higher than required to meet the cap in year 2025. We anticipate that there will be technology innovations in the future, i.e., the marginal cost curves will shift downward over time before higher levels of mitigation are necessary.

### Economy-wide Stepwise and Fitted Marginal Cost Curve of MN, 2025



Note: The red step and fitted curves are for the sensitivity cases in which RPS and CIP are incorporated in the 2025 BAU emission projection and the corresponding options are removed from the options list to develop the cost curve. The blue step and fitted curves are for the cases without RPS and CIP in the BAU condition, but with the RPS and CIP in the options list for the cost curves.

Emission Trading Simulation Among Four Sectors in Minnesota (assuming RPS & CIP in baseline)  
(million dollars or otherwise specified)

State	Before Trading	After Trading <sup>a</sup>			Cost Saving	Permits Traded	Emission Reduction After Trading		Emission Reduction Cap
	Mitigation Cost	Mitigation Cost	Trading Cost	Net Cost		(million tCO <sub>2</sub> e)	(million tCO <sub>2</sub> e)	(percent from BAU)	(percent from BAU)
Power Sector	125	77	40	117	8	0.94	3.74	9.20	11.50
Transportation Sector	-42	171	-317	-146	104	-7.45	26.04	58.33	41.64
Other	3,608	197	927	1,124	2,484	21.82	12.07	15.37	43.16
Sequestration	0	61	-650	-590	590	-15.31	15.31	n.a.	n.a.
Total	3,691	505	0	505	3,186	22.76 <sup>b</sup>	57.16	34.88	34.88

<sup>a</sup> Permit Price = \$42.49/tonCO<sub>2</sub>e.

<sup>b</sup> Represents number of permits bought or sold.

Please note the simulation indicates a permit price of \$42.5/tonCO<sub>2</sub>e for a cap and trade program among sectors of MN only. In contrast, the autarkic marginal cost level of MN to reach a 34.88% reduction from the 2025 BAU emission level is \$48/tonCO<sub>2</sub>e, as indicated by the MN economy-wide cost curve. Ideally, the two marginal cost/permit price numbers should be the same. One possible reason of the difference here is that when we fit cost curves for individual sectors, the deviations from the actual points is amplified, because we have only a few observation points for each sector. For example, after we exclude RPS and CIP from the power sector options list, there are only 4 options in this sector. It is hard to derive an accurate cost curve from a small number of observation points. This dilemma highlights the importance of having more than just a few observations for fitting the curves if we want to be accurate. Therefore, \$48/tonCO<sub>2</sub>e indicated by the economy-wide curve is likely to be more accurate in reflecting the MN marginal cost level to accomplish the reduction target on its own. Note, however, many of the simulation results of the MN-only simulation, such as which sector would be the biggest seller or buyer within the state, is still be useful despite the limitations in accuracy of the cost curves.

## C&T-4. Carbon Tax

### Policy Description

A carbon tax sets a fee, or tax, for the release of carbon to the atmosphere. It does not set a limit, reduce or otherwise control the tons of carbon released. The tax raises the cost of carbon-based emissions and therefore encourages investment in low-carbon or no-carbon alternatives. It also generates revenue for the government which could be directed toward energy efficiency, the development and use of renewable energy, climate change adaptation investments and other measures to mitigate or address the impacts of climate change. A carbon tax could be implemented as a tax on fossil fuels according to the amount of CO<sub>2</sub> emitted by their combustion. One of the benefits is that it can be more easily applied across all sectors.

It is assumed that the cost of the tax would be passed down to the ultimate consumer, such as residential and commercial utility ratepayers for electricity. In order to achieve the stated goal, the amount of the tax must be high enough to trigger financial and behavioral decisions toward conservation or a shift to lower emitting fuels.

### Policy Design

**Goals:** Make the cost of inefficient or higher CO<sub>2</sub> emitting activities more expensive than alternatives, thereby creating a financial incentive to change behavior away from activities that result in CO<sub>2</sub> emissions. The tax should include safety valves to reduce low-income impact and minimize detrimental economic consequences. One option is to make the tax “revenue neutral,” (an equal amount of other state taxes would be reduced so that the “net” to the state is zero); or the revenue from the tax could be used to develop or promote alternatives that reduce CO<sub>2</sub> emissions. The amount of the tax should be high enough to contribute to the reduction targets specified in statute.

**Timing:** TBD—[as needed and approved by the TWGs]

**Parties Involved:** Major payers would be utilities that generate or distribute electricity in Minnesota; refiners or distributors of transportation and heating fuels in Minnesota; and commercial and industrial sources creating energy for production or other commercial use.

**Other:** N/A

### Implementation Mechanisms

This option requires legislation and the creation or expansion of administrative tax collection and enforcement capabilities.

## C&T-5. Market Advisory Group (Formerly CC-11)

### Policy Description

The CC TWG recommends that Minnesota create a “Market Advisory Group” consisting of experts to provide guidance to the state on the design of market-based compliance programs to manage GHG emissions. The State of California has formed a Market Advisory Committee (MAC) to help formulate a GHG cap-and-trade system in California. The California MAC has formulated a set of guiding principles and has developed an initial set of recommendations for a California Cap-and-Trade program. It is recommended that Minnesota convene a similar “Market Advisory Group” to receive the policy recommendations of the MCCAG and provide expert guidance to the state on the design of a Minnesota market-based compliance program to manage GHG emissions.

### Policy Design

**Goals:** The Cap-and-Trade TWG and the MCCAG expect to recommend the creation of a cap-and-trade program to help manage GHG emissions. This recommendation will contain policy guidance in the areas of jurisdictional coverage, sector coverage, timing, allowance distribution, safety valve, offsets and possibly others. Before a program can be implemented, however, this guidance must be refined into a detailed program design. The appointment of a Market Advisory Group is recommended for this purpose.

**Timing:** In order to provide the earliest possible guidance to covered sectors the Market Advisory Group should be appointed as soon after the MCCAG recommendation for a cap-and-trade program is accepted by policy makers.

**Parties Involved:** Unlike the MCCAG, which is stakeholder-driven, the Market Advisory Group should be comprised of individuals with particular expertise in key areas such as economics, markets, climate science and policy, cap-and-trade programs in other jurisdictions or for other pollutants, key covered sectors, finance, etc.

**Other:** The committee should encourage public comment throughout their deliberations.

### Implementation Mechanisms

The Market Advisory Group could be created by executive order or by legislative act, and should serve for a limited time. The product of the Market Advisory Committee’s deliberations should be a report or reports recommending in some detail the scope, design and plan for implementation of the Minnesota cap-and-trade program.

## C&T-6. Participate in Regional and Multi-State GHG Reduction Efforts (Formerly CC-7)

### Policy Description

Regional approaches undertaken in collaboration with partner states or other organizations can offer broader and more economically efficient opportunities to reduce GHG emissions across Minnesota's economy. There are several options for regional, market-based GHG reduction strategies which should be considered in Minnesota such as: joining the Western Climate Initiative (WCI), joining the Northeast States RGGI, or instituting a new Midwestern states GHG initiative. Additional examples might include consideration of the California vehicle standards, cost sharing on multistate initiatives, etc.

### Policy Design

**Goals:** Ensure the cost effective reduction of GHG emissions to at least the reduction levels set forth in Minnesota statute, in a manner that maximizes public benefits and induces innovation in energy efficiency and sustainable energy technologies and avoids inequitable impacts.

**Timing:** By February 1, 2008, the Administration must report to the legislature on its investigation into regional GHG reduction opportunities. By August 1, 2009 Minnesota should either join an existing GHG reduction initiative or institute and join a new Midwestern states GHG initiative that will ensure that Minnesota achieves the goal, as stated above.

**Parties Involved:** The Governor and administration staff should implement the legislative directive (see below) and inform the chairs and ranking minority members of the legislative committees with jurisdiction over energy and environmental finance and policy.

### Other:

### Implementation Mechanisms

Next Generation Energy Act, S.F. No. 145, Article 5, Sec. 2, Subd. 6 (Regional activities). The state must, to the extent possible, with other states in the Midwest region, develop and implement a regional approach to reducing GHG emissions from activities in the region, including consulting on a regional cap-and-trade system.

### Related Policies/Programs in Place

Next Generation Energy Act, S.F. No. 145, Article 5, Sec. 2, Subd. 6 (Regional activities). See above.

## C&T-7. Facilitate the Development of an Effective Carbon Credit System for Minnesota (Formerly CC-10)

### Policy Description

GHG reductions from a wide variety of sources and actors could potentially be undertaken in order to participate in offset programs or markets. Minnesota could develop an offset program as a state-led or private effort. Under this policy, the preferred approach is for entities to participate in an official state-recognized registry. However, for entities not covered by the registry, the policy should allow for offsets to be submitted as a way to opt in to GHG emission allowance markets or trading systems. Such offsets would be registered using approved protocols or (in the absence of protocols) an application for approval of specific projects on a case-by-case basis. The effectiveness of such offsets is likely to help determine their value and utility for participants. In particular, concerns about measurement, permanence, additionality, and enforceability must be resolved in the protocol-setting process; measures such as categorical exclusions and temporary credits for certain types of emission-reducing actions should be considered. However, the administrative burden and/or transaction costs that could be imposed could have a countervailing (dampening) effect, leading to an overall increase in costs.

### Policy Design

**Goals:** Enable a wide range of quality offsets to be generated, preferably in Minnesota, with the applicability of such offsets to be determined as state, regional, national and international GHG reduction efforts continue to develop. Criteria for such an offset system in Minnesota might include those described in the cap-and-trade webinar ( real, surplus (additional), verifiable, permanent and enforceable).

**Timing:** By January 1, 2009, establish an offset program including at least the major sectors for which existing GHG emission reduction protocols exist or are developed for use by Minnesota entities. To the extent that Minnesota's participation in *The Climate Registry* will enable certain sectors and/or entities to participate in offset creation, those sectors and/or entities would not be included in the separate offset program under this policy.

**Parties Involved:** Minnesota Department of Commerce and Minnesota Pollution Control Agency along with other appropriate partners. The offset program tracking and administration could be formed with the same agency structure as envisioned for the State's participation in the Climate Registry. A stakeholder and public comment process should be employed during 2008 to determine types of offsets and relevant protocols for inclusion.

**Other:** Consider a State purchase of offsets using an RFP process to jump start the market, versus strong advocacy for rapid development of national or regional offset systems.

# Public Input & Announcements

# Next Meeting

- Scheduled for January 11, 2008
  - Agenda items?