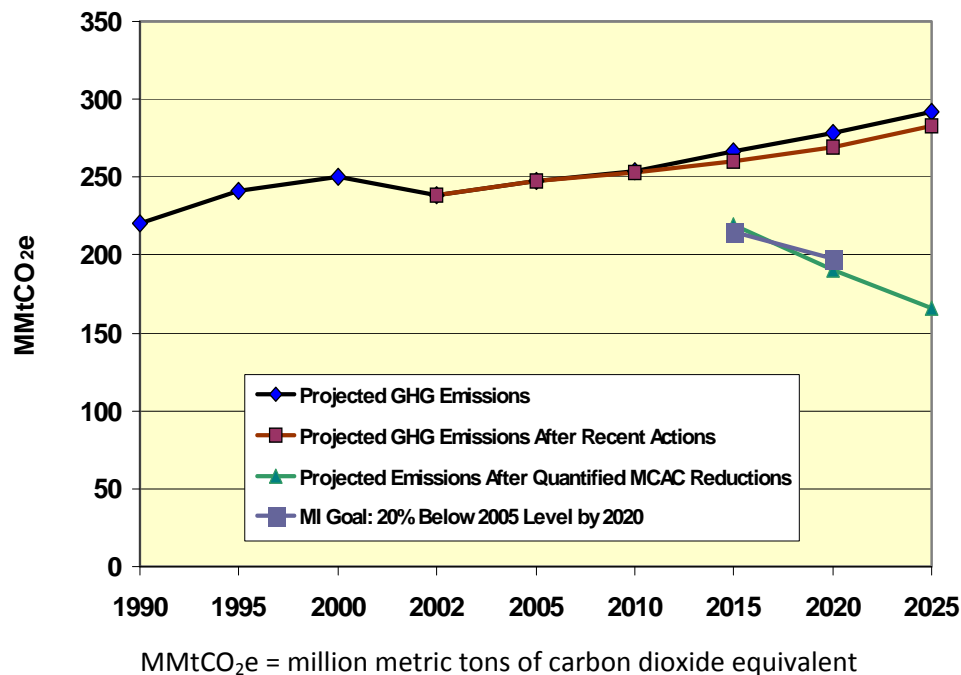


Michigan Climate Action Plan Summary

On November 14, 2007 Governor Jennifer Granholm signed Executive Order 2007-42 creating the [Michigan Climate Action Council \(MCAC\)](#) and charged it with producing a [Greenhouse Gas \(GHG\) Emissions Inventory and Forecast](#) and a comprehensive [Climate Action Plan](#) with recommended emissions reduction goals and policy actions to mitigate climate change in all sectors of the economy, including state and local government. Steve Chester, Michigan Department of Environmental Quality Director, chaired, the MCAC.

In February 2009, after a more than a year of intensive stakeholder collaboration, the MCAC recommended 54 climate mitigation policy actions. Of these, 33 were analyzed to quantify GHG reductions, costs or savings, environmental benefits, and feasibility of implementation. Combined with actions already underway, recommendations would reduce GHGs to more than 20 percent below 1990 levels by 2020 and generate net savings of \$10 billion from 2009 to 2025, according to estimates approved by the MCAC.

GHG Reduction Potential from Michigan's Recent and Proposed Actions
(CCS analysis, 2009)



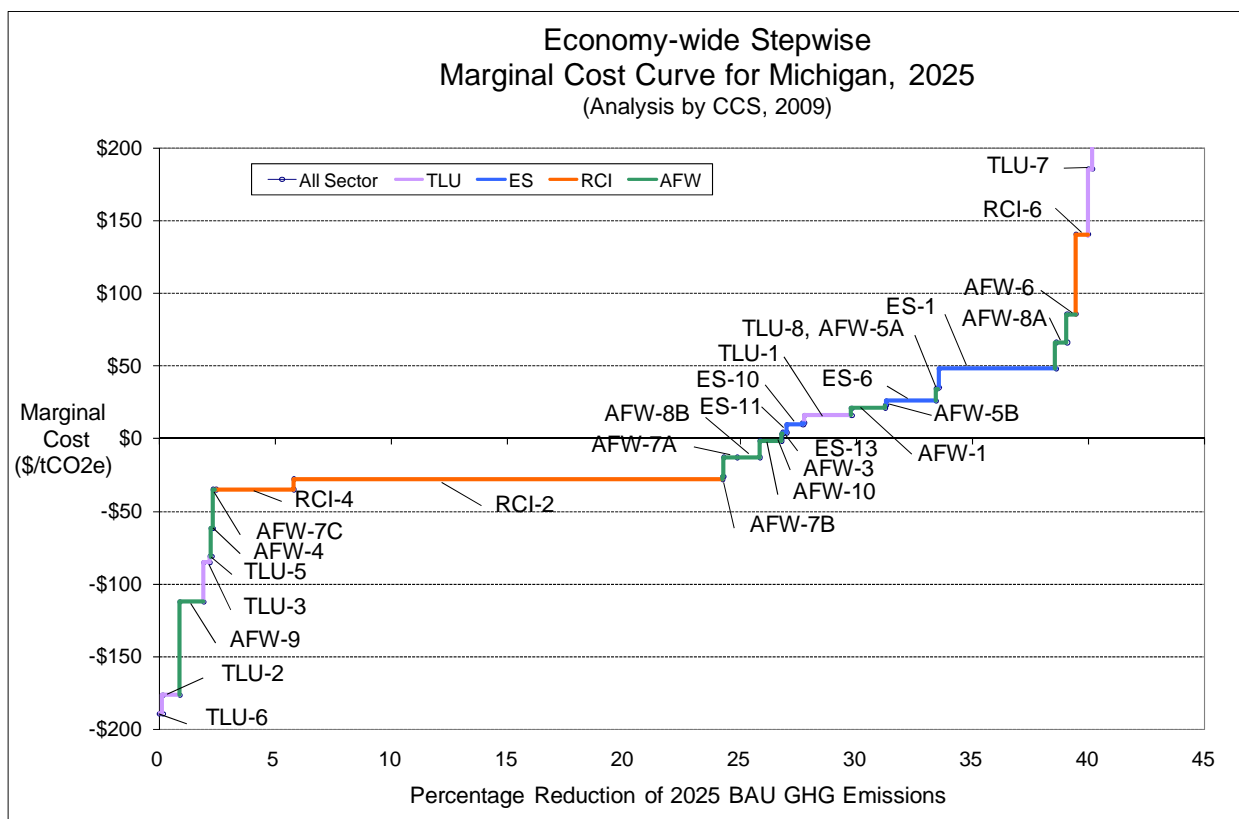
The [Center for Climate Strategies \(CCS\)](#) provided facilitation and technical support to the more than 100 diverse members of the Action Council who were appointed by the

Governor and state agencies. Members served on [Technical Work Groups](#) that focused on policy development for all sectors of the Michigan economy. These include:

- [Agriculture, Forestry and Waste Conservation](#)
- [Clean and Renewable Energy \(Heat and Power Generation\)](#)
- [Energy Conservation and Efficiency \(Heat and Power Consumption\)](#)
- [Transportation and Land Use Improvements](#)

The cost curve below shows the cost effectiveness of many of the specific policy options in these sectors (represented by each color coded and labeled line segment) in terms of their savings or costs and their contribution to reducing GHGs. Negative values (below the \$0 midline) represent net cost savings, and positive values (above the midline) represent net costs associated with the policy option.

Estimated Costs and Savings for Michigan Climate Mitigation Actions



BAU = business as usual; GHG = greenhouse gas; tCO₂e = metric tons of carbon dioxide equivalent; AFW = Agriculture, Forestry, and Waste Management; ES = Energy Supply; TLU = Transportation and Land Use; RCI = Residential, Commercial and Industrial

The [Michigan Climate Plan](#) is one of [30 such state plans](#) that have been completed or are underway by U.S. states. Its comprehensive structure includes an emissions target, a cap-and-trade program, and a comprehensive set of sector based policies and

measures. Its design is consistent with national climate policy proposed in the [U.S. Congress](#) and the Administration.

Summary Tables of Climate Mitigation Recommendations

The tables below list the Michigan Climate Action Council's (MCAC's) recommended policies by sector/Technical Work Group and show results of analyses quantifying GHG reductions, costs or savings, and cost effectiveness. Some recommendations were not quantified due to data limitations or other factors. Analysis was conducted by CCS according to specifications by Technical Work Groups and approvals by the MCAC.

KEY: MMtCO₂e = million metric tons carbon dioxide equivalent; \$/tCO₂e = dollars per ton carbon dioxide equivalent, NQ = not quantified, NA = not applicable

Note: Negative numbers indicate *cost savings*.

Energy Supply (ES)						
Policy No.	Policy Recommendation	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)
		2015	2025	Total 2009–2025		
RECENT ACTION	PA 295, Clean, Renewable, and Efficient Energy Act	2.7	2.0	30.8	\$1,024	\$33
ES-1	Renewable Portfolio Standard and Distributed Generation "Carve-Out"	5.0	14.6	137.5	\$6,600	\$48.00
	Renewable Portfolio Standard (RPS)	4.6	13.7	129.5	\$5,546	\$42.83
	Wind	3.7	10.3	100.4	\$4,748	\$47.31
	Biomass	0.9	2.7	25.2	\$376	\$15
	Solar Photovoltaic (PV)	0.0	0.4	2.6	\$392	\$152
	Plasma Gasification	0.0	0.3	1.3	\$29	\$22
	Distributed Generation "Carve-Out"	0.4	0.9	8.0	\$1,054	\$131.51
	Solar Hot Water	0.0	0.2	1.2	\$26	\$22.27
	Geothermal	0.1	0.2	1.5	\$82	\$55
	Wind (distributed)	0.1	0.3	2.7	\$503	\$186
	Solar PV (distributed)	0.1	0.2	1.84	\$508	\$276
	Biogas	0.1	0.2	2.3	\$17	\$7
ES-3	Energy Optimization Standard	0.0	13.6	86.3	-\$1,632	-\$19
ES-5	Advanced Fossil Fuel Technology (e.g., IGCC, CCSR) Incentives, Support, or Requirements	Not Quantifiable				
ES-6	New Nuclear Power	0.0	6.3	38.5	\$1,001	\$25.98

Energy Supply (ES)						
Policy No.	Policy Recommendation	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)
		2015	2025	Total 2009–2025		
ES-7	Integrated Resource Planning (IRP), Including Combined Heat & Power (CHP)	Not Quantifiable				
ES-8	Smart Grid, Including Advanced Metering	Not Quantifiable				
ES-9	CCSR Incentives, Requirements, R&D, and/or Enabling Policies	Not Quantifiable				
ES-10	Technology-Focused Initiatives (Biomass Co-firing, Energy Storage, Fuel Cells, Etc.), Including Research, Development, & Demonstration					
	Co-firing at 5%	0.2	0.2	3.3	\$34.48	\$10.6
	Co-firing at 10%	0.5	0.5	6.5	\$69.43	\$10.7
	Co-firing at 20%	0.9	0.9	13.0	\$134.09	\$10.3
ES-11	Power Plant Replacement, Energy Efficiency, and Repowering	2.5	2.0	33.2	\$313	\$9.4
ES-12	Distributed Renewable Energy Incentives, Barrier Removal, and Development Issues, Including Grid Access	ES-12 Fully incorporated in distributed generation "carve-out" under ES-1.				
ES-13	Combined Heat and Power (CHP) Standards, Incentives and/or Barrier Removal	0.4	0.5	7.8	\$31.91	\$4.09
ES-15	Transmission Access and Upgrades	Not Quantifiable				
	Sector Totals	8.1	37.2	306.6	\$6,348	\$22
	Sector Total After Adjusting for Overlaps	8.1	23.6	220.3	\$7,980	\$36
	Reductions From Recent Actions	2.7	1.9	30.1	\$1,025	\$34
	Sector Total Plus Recent Actions	10.8	25.5	250.4	\$9,005	\$36

Market Based Policy (MBP)						
Policy No.	Policy Recommendations	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)
		2020	2025	Total 2009–2025		
MBP-1	20% below 2005 by 2020 (<i>Free-Granting Allowances</i>)	92.48				–\$25.83
	Cap and Trade* 20% Below 2005 by 2020 (<i>Auctioning Allowances</i>)	92.48				–\$19.33
MBP-3	Michigan Joins Chicago Climate Exchange	Not Quantified				
MBP-6	Market Advisory Group	Not Quantifiable				
* For details on the costs included see Appendix G of the MCAC Report						

Transportation and Land Use (TLU)						
Policy No.	Policy Recommendations	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)
		2015	2025	Total 2009–2025		
TLU-1*	Promote Low-Carbon Fuel Use in Transportation	2.6	5.9	53	\$820	\$16
TLU-2	Eco-Driver Program	1.1	2.2	22	–\$3,921	–\$176
TLU-3	Truck Idling Policies	0.36	0.76	7.0	–\$596	–\$85
TLU-4	Advanced Vehicle Technology	0.01	0.03	0.19	\$281	\$1,458
TLU-5	Congestion Mitigation	0.08	0.18	1.7	–\$135	–\$81
TLU-6	Land Use Planning and Incentives	0.14	0.43	3.2	–\$598	–\$189
TLU-7	Transit and Travel Options	0.13	0.54	3.5	\$655	\$185
TLU-8	Increase Rail Capacity, and Address Rail Freight System Bottlenecks	0.10	0.19	2.0	\$69	\$35
TLU-9	Great Lakes Shipping	0.24	0.27	2.5	NQ	NQ
	Sector Totals	4.76	10.5	95.1	–\$3,425	–\$36
	Sector Total After Adjusting for Overlaps	4.76	10.5	95.1	–\$3,425	–\$36
	Reductions From Recent Actions	0	0	0	\$0	\$0
	Sector Total Plus Recent Actions	4.76	10.5	95.1	–\$3,425	–\$36

* TLU-1 addresses the consumption of biofuels in Michigan. The quantification results for AFW-2 (biofuel production volumes and costs), were used as inputs to the estimates for low-carbon fuel use in TLU-1.

Residential, Commercial and Industrial (RCI)						
	Policy Recommendations	GHG Reductions (MMtCO₂e)			Net Present Value 2009–2025 (Million \$)	Cost-Effectiveness (\$/tCO₂e)
		2015	2025	Total 2009–2025		
RCI-1	Utility Demand-Side Management for Electricity and Natural Gas	0.0	13.6	86.3	–1,632	–19
RCI-2	Existing Buildings Energy Efficiency (EE) Incentives, Assistance, Certification, and Financing	17.6	53.8	428.6	–12,107	–28
RCI-3	Regulatory / Public Service Commission Changes to Remove Disincentives and Encourage EE Investments by Investor Owned Utilities	Not Quantifiable				
RCI-4	More Stringent Bldg. Codes for EE	3.6	9.8	82	–2,865	–35
RCI-5	MI Climate Challenge & Related Consumer Education Programs	Not Quantifiable				
RCI-6	Incentives to Promote Renewable Energy Systems Implementation	0.7	1.5	14.0	1,958	140
RCI-7	Promotion and Incentives for Improved Design and Construction in the Private Sector	15.6	47.6	380	–11,693	–31
RCI-8	Net Metering for Distributed Generation	Fully incorporated into RCI-6				
RCI-9	Training & Education for Bldg. Design, Construction, and Operation	Not Quantifiable				
RCI-10	Water Use and Management	Not Quantifiable				
	Sector Total After Adjusting for Overlaps (net of recent legislation)	21.8	64.9	523.9	–13,014	–24.8
	Reductions From Recent Actions	Figures adjusted include recent actions				
	Sector Total Plus Recent Actions	21.8	64.9	523.9	–13,014	–24.8

Agriculture, Forestry and Waste (AFW) Management							
Policy No.	Policy Recommendation		GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million 2005\$)	Cost-Effectiveness (\$/tCO ₂ e)
			2015	2025	Total 2009–2025		
AFW-1	Expanded Use of Biomass Feedstocks for Electricity, Heat, or Steam Production		3.3	10	79	\$1,649	\$21
AFW-2*	In-State Liquid Biofuels Production		<i>Included in the Results of TLU-1</i>				
AFW-3	Methane Capture and Utilization From Manure and Other Biological Waste		0.09	0.14	1.5	\$4.7	\$3
AFW-4	Expanded Use of Bio-based Materials	A. Use of Bio-based Products	.08	.21	1.7	–\$108	–\$62
		B. Utilization of Solid Wood Residues	Not Quantified				
AFW-5	Land Use Management That Promotes Permanent Cover	A. Increase in Permanent Cover Area	0.08	0.21	1.8	\$63	\$34
		B. Retention of Lands in Conservation Programs [†]	0.05	0.11	1.1	\$24	\$23
		C. Retention/Enhancement of Wetlands	Not Quantified				
AFW-6	Forestry and Agricultural Land Protection	A. Agricultural Land Protection	0.46	1.1	10	\$864	\$85
		B. Forested Land Protection	<i>Not Quantified</i>				
		C. Peatlands/Wetlands Protection	<i>Not Quantified</i>				
AFW-7*	Promotion of Farming Practices That Achieve GHG Benefits	A. Soil Carbon Management	0.7	1.7	15	–\$200	–\$13
		B. Nutrient Efficiency	0.05	0.12	1.1	–\$27	–\$26
		C. Energy Efficiency	0.13	0.32	2.9	–\$102	–\$35
		D. Local Food	Not Quantified				

Agriculture, Forestry and Waste (AFW) Management							
Policy No.	Policy Recommendation		GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million 2005\$)	Cost-Effectiveness (\$/tCO ₂ e)
			2015	2025	Total 2009–2025		
AFW-8	Forest Management for Carbon Sequestration and Biodiversity	A. Enhanced Forestland Management	0.53	1.42	12.05	\$800	\$66
		B. Urban Forest Canopy	1.2	2.9	26	–\$346	–\$13
		C. Reduce Wildfire	Not Quantified				
AFW-9*	Source Reduction, Advanced Recycling, and Organics Management						
	In-State GHG Reductions		1.4	3.0	28	–\$3,136	–\$112
	Full Life-Cycle Reductions		14.5	35.3	314	–\$3,136	–\$10
AFW-10	Landfill Methane Energy Programs		0.91	2.7	22	–\$35	–\$2
	Sector Totals*		9	23	201	–\$548	–\$3
	Sector Total After Adjusting for Overlaps*		6	17	147	–\$1,634	–\$11
	Reductions From Recent Actions		N/A	N/A	N/A	N/A	N/A
	Sector Total Plus Recent Actions		6	17	147	–\$1,634	–\$11

* For details on the quantification results, life cycle costing, sector totals and overlap adjustments see [Appendix J of the MCAC Report](#)

Cross Cutting Issues (CCI)							
Policy No.	Policy Recommendation		GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost Effectiveness (\$/tCO ₂ e)
			2015	2025	Total 2009–2025		
CCI-1	GHG Inventories, Forecasting, Reporting, and Registry		Not Quantified				
CCI-2	Statewide GHG Reduction Goals and Targets		Not Quantified				

Cross Cutting Issues (CCI)						
Policy No.	Policy Recommendation	GHG Reductions (MMtCO ₂ e)			Net Present Value 2009–2025 (Million \$)	Cost Effectiveness (\$/tCO ₂ e)
		2015	2025	Total 2009–2025		
CCI-3	State, Local, and Tribal Government GHG Emission Reductions (Lead-by-Example)	Not Quantified				
CCI-4	Comprehensive Local Government Climate Action Plans (Counties, Cities, Etc.)	Not Quantified				
CCI-5	Public Education and Outreach	Not Quantified				
CCI-6	Tax and Cap/ Cap and Trade	MCAC approved creation of a new Market-Based Policies Technical Work Group as the lead for this policy recommendation.				
CCI-7	Seek Funding for Implementation of MCAC Recommendations	Not Quantified				
CCI-8	Adaptation and Vulnerability	Not Quantified				
CCI-9	Participate in Regional, Multi-State, and National GHG Reduction Efforts	Not Quantified				
CCI-10	Enhance and Encourage Economic Growth and Job Creation Opportunities Through Climate Change Mitigation	Not Quantified				
CCI-11	Enhance and Encourage Community Development Through Climate Change Mitigation: Address Environmental Justice	Not Quantified				

Summary Table of Michigan Climate Action Plan Recommended Policies
(Consolidated Policy Options for Macroeconomic Analysis)

Updated MI Consolidated Options	Total 2009-2025 GHG Reductions (MMtCO₂e)	Net Policy Cost NPV 2009-2025 (Million \$)	Cost-Effectiveness (\$/tCO₂e)	GSP Benefit NPV 2009-2025 (Billion \$)	Employment Benefit 2025 (thousands FTE)
Energy Supply	188.92	\$5,509.00	\$29.16	\$2.16	4.50
ES Consolidated Option #1: Renewable Portfolio Standard	107.28	\$4,413.00	\$41.14	\$1.41	2.02
ES Consolidated Option #2: Nuclear	46.27	\$1,001.00	\$21.63	\$0.47	1.52
ES Consolidated Option #3: Coal Plant Efficiency Improvements and Repowering	35.38	\$95.00	\$2.67	\$0.16	0.21
ES Consolidated Option #4: Combined heat and power	7.97	\$35.40	\$4.44	\$0.12	0.75
Residential, Commercial, and Industrial	522.46	-\$14,578.13	-\$27.90	\$11.05	43.05
RCI Consolidated Option #1: Demand Side Management Programs	229.23	-\$6,278.33	-\$27.39	\$5.07	19.12
RCI Consolidated Option #2: High Performance Buildings (private and public sector)	203.28	-\$5,567.57	-\$27.39	\$4.37	16.28

Updated MI Consolidated Options	Total 2009-2025 GHG Reductions (MMtCO ₂ e)	Net Policy Cost NPV 2009-2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	GSP Benefit NPV 2009-2025 (Billion \$)	Employment Benefit 2025 (thousands FTE)
RCI Consolidated Option #3: Building Codes	81.98	-\$2,767.63	-\$33.76	\$1.62	7.64
Transportation and Land Use	68.10	\$384.34	\$5.64	\$4.12	14.18
TLU Consolidated Option #1: Anti-Idling Technologies and Practices	6.61	-\$316.71	-\$47.92	\$0.55	0.99
TLU Consolidated Option #2: Vehicle Purchase Incentives, including rebates	0.18	\$254.25	\$1,411.33	-\$0.22	-0.76
TLU Consolidated Option #3: Mode Shift from Truck to Rail	2.09	\$194.53	\$93.12	-\$0.33	-0.13
TLU Consolidated Option #4: Renewable Fuel Standard (biofuels goals)	52.89	\$219.71	\$4.15	\$3.23	11.16
TLU Consolidated Option #5: Transit	3.17	\$325.95	\$102.86	\$0.68	1.80
TLU Consolidated Option #6: Smart Growth/Land Use	3.16	-\$293.39	-\$92.84	\$0.21	1.13

Updated MI Consolidated Options	Total 2009-2025 GHG Reductions (MMtCO ₂ e)	Net Policy Cost NPV 2009-2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	GSP Benefit NPV 2009-2025 (Billion \$)	Employment Benefit 2025 (thousands FTE)
Agriculture, Forestry and Waste Management	311.50	\$8,962.85	\$28.77	-\$0.35	20.06
AFW Consolidated Option #1: Soil Carbon Management	15.56	-\$209.68	-\$13.47	\$0.12	0.37
AFW Consolidated Option #2: Nutrient Management	1.25	-\$27.33	-\$21.91	\$0.02	0.10
AFW Consolidated Option #3: Livestock Manure - Anaerobic Digestion and Methane Utilization	1.46	\$2.52	\$1.72	\$0.00	0.01
AFW Consolidated Option #4: MSW Landfill Gas Management	21.99	-\$48.82	-\$2.22	\$0.29	1.03
AFW Consolidated Option #5: Enhanced Recycling of Municipal Solid Waste	236.02	\$3,891.12	\$16.49	\$1.92	3.10
AFW Consolidated Option #6: Reforestation / Afforestation	7.98	\$362.48	\$45.44	-\$0.18	-0.38

Updated MI Consolidated Options	Total 2009-2025 GHG Reductions (MMtCO ₂ e)	Net Policy Cost NPV 2009-2025 (Million \$)	Cost-Effectiveness (\$/tCO ₂ e)	GSP Benefit NPV 2009-2025 (Billion \$)	Employment Benefit 2025 (thousands FTE)
AFW Consolidated Option #7: Urban Forestry	27.24	\$4,992.56	\$183.26	-\$2.53	15.83
Summation Total	1,090.00	\$278.06	\$0.25	\$16.98	81.79
Simultaneous Total	1,090.00	\$278.06	\$0.25	\$25.26	129.49