

Recommendations for Decarbonization from a Materials Perspective

Materials Decarbonization Work Group

September 30, 2021

Materials Decarbonation Workgroup Recommendations

Introduction

Every Michigan resident participates in the economy, consumes materials, and generates waste. The products of our economic activity depend on a linear model that burns fossil fuels for resource extraction, production, distribution, consumption, and disposal. Every material we consume has a carbon footprint that continually increases, including after the product has been consumed. As Michigan transitions to a low carbon economy, it becomes increasingly important to assess the entire life cycle of the materials we consume and reassess our current economic model and consumption patterns.

The recommendations that follow are grounded in a decade-long stakeholder process, led by EGLE, to shift the standard consumption paradigm from a waste management centered model to one that rightly views value in all materials and strives to keep that value circulating in the economy. This shift has been pursued through a focus on source reduction, reuse, and increasing recycling with commensurate investment and engagement from the private sector.

Our 14 recommendations below present actionable strategies to immediately accelerate decarbonization and provide opportunities for every Michigan resident to equitably participate in decarbonization and co-create a circular economy. A circular economy maintains the value of products and materials, avoids waste, and keeps resources within the economy even after a product has reached the end of its life (Geisendorf & Pietrulla, 2018). This full systems redesign has the potential to dramatically reduce greenhouse gas emissions throughout the entire economic system.

The Materials Management Decarbonization workgroup thanks the Council on Climate Solutions for its critical work and urges swift action on our recommendations.

Reduce Recommendations

1) Food Waste

Michigan should establish a coordinated and comprehensive food waste reduction plan, focused first on source reduction, that supports the joint USDA and USEPA goal to reduce food loss and waste by half by the year 2030. Achieving this goal should align with the United National Sustainable Development Goal 12.3. The plan should draw on the ReFED Road map to 2030 and food waste reduction guidance published by the United Nations Environment Programme.

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Impact Potential: Currently, 509,542.52 metric tons of CO₂e (MTCO₂e) emissions are generated in Michigan annually from landfilling food waste and an additional 3,979,360 MTCO₂e emissions are associated with the production and generation of that wasted food.

II) Implement Policies to Drive Manufacturing and Procurement of Sustainable Products

Michigan should evaluate and implement current policies and identify barriers to drive manufacturing and procurement of sustainable products – including low carbon and circular economy products. Public and private procurement is a critical lever to create demand for sustainable products. We recommend that the state form a workgroup to develop, evaluate, and implement a procurement policy to encourage or require the purchase of certain industrial products that achieve carbon intensity or circular economy benchmarks. Such a policy would create a market demand for existing sustainable products and support industry to develop future innovations to reduce emissions and waste. The workgroup should evaluate the effectiveness of [Section 18.1261a](#) which requires state agencies to purchase supplies, materials, and equipment made from recycled materials. The workgroup should include both state government and industry stakeholders and should recommend specific policy language and design, including ways to value both climate and circularity benefits in tandem.

III) Seek Waste Prevention Strategies:

Michigan should focus interventions on prevention following the principles outlined in the [Waste Management Hierarchy](#) and [Zero Waste Hierarchy](#). Businesses, individuals, and organizations can maximize economic gains while increasing social and environmental benefits. Focusing first on reductions in food waste, solid waste, and single use plastic should be the priority.

IV) Promote product stewardship:

Michigan should promote the adoption of Product Stewardship and Extended Producer Responsibility frameworks for certain materials to extend product lifecycles and promote a circular economy. Priority materials include packaging material, textiles, paint, and batteries.

V) Invest in research and development of sustainable packing:

Michigan should invest in research to better understand the lifecycle decarbonization impacts of packaging materials to impact design criteria and aid in making sound economic and environmentally conscious decisions.

VI) Public Education and Outreach:

Michigan should conduct education and outreach to increase consumer and industry awareness of the scale of carbon impact of single-use materials and how residents can contribute to decarbonization through their everyday actions. Decarbonization through a materials lens represents a unique opportunity, as all Michigan residents can participate in decarbonization through behavior change with the goal of increasing demand for more sustainable, less carbon intensive materials.

VII) Improve the Data:

Michigan should encourage companies and organizations in the private and public sectors to develop and share robust data sets so that we can better track progress toward decarbonization. By collecting valid data, businesses can justify sustainable materials investments, tailor their reduction programs, and gain new insights on opportunities to prevent and reduce waste.

VIII) Forge New Partnerships and Expand the Existing Ones:

Michigan should leverage existing partnerships and create new partnerships to advance source reduction decarbonization strategies. When organizations collaborate, they can share existing infrastructures, resources, and expertise which make their operations more sustainable and accelerate decarbonization.

IX) Product Design

Michigan should support initiatives to promote decarbonization through product and material design.

Reuse Recommendations

I) Expand Reuse Economy

Michigan should foster the increased reuse of materials, so the embodied carbon is used to its fullest extent rather than wasted. Strategies such as technical Assistance, education and outreach, incentives, and increased research should be employed to increase reuse.

Impact Potential: The way we produce, consume, and dispose of our goods and food accounts for 45% of our greenhouse gas emissions (Ellen Macarthur Foundation, 2019). Increasing reuse reduces greenhouse gas emissions.

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Recycle Recommendations

I) Compost and Anaerobic Digester

Michigan should establish a coordinated effort to support municipalities and the private/commercial sector to implement remedies such as compost facilities and anaerobic digesters to divert large amounts of food waste and other organic materials from landfills while also creating energy and generating revenue from these activities.

Impact Potential: 38% of Municipal Solid Waste currently sent to landfill is recoverable organics (Resource Recycling Systems, 2019).

II) Circular Economy

Michigan should work to continue to grow our circular economy where materials are returned to their highest and best use so that Michigan achieves a 45% recycling rate and materials efficiently find their way from the curb to a new product made here in Michigan.

Michigan's Circular Economy should be supported through efforts encompassed by [NextCycle Michigan](#) including:

- Growing local and statewide recycling markets.
- Improving the efficiency of Michigan's collection and processing infrastructure.
- Growing and incubating business that foster Michigan's circular economy.
- Using data to drive decisions.
- Taking a systems approach to ensuring all materials are utilized rather than disposed.

Impact Potential: Growing Michigan's Circular Economy and tripling our recycling rate would avoid more than 10,355,618 MTCO_{2e} annually (Resource Recycling Systems, 2019).

End of Life Recommendations

I) Capture Landfill Gas Emissions

Michigan should enact the proposed stakeholder supported legislative amendments to Part 115, Solid Waste Management, of the Natural Resources and Environmental Protection Act, PA 451, as amended. Once enacted and implemented, these proposed amendments will reduce the release of Earth-warming methane from landfills by requiring the installation and/or maintenance of gas capture systems that meet revised state regulatory standards. These statutory changes would require monitoring of

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landfills for fugitive gas emissions and require rigorous gas collection system monitoring to ensure efficient system operation.

Impact Potential: 2,997,526 MTCO₂e could be avoided over 2019 levels. This equates to yearly electric usage for 544,479 homes.

II) Landfill Gas to Energy Development

Michigan should promote increased use of energy recovery systems at landfills.

Michigan already has a significant number of successful landfill gas to energy recovery systems in operation. EGLE recommends continued support of these efforts and working with other landfill owners to advance cost-effective voluntary energy recovery projects at landfills. Landfill gas to energy systems reduce carbon and methane emissions, support local/regional sources of energy, and avoid emissions from other fossil fuel sources of electrical generation. Other landfill gas energy recovery projects that have been implemented and should continue to be supported include compressed landfill gas fueling stations for vehicles, landfill gas scrubbing and compression for pipeline input, and use of landfill gas as an industrial boiler fuel source. All these projects avoid emissions from fossil fuel sources and represent renewable energy recovery.

Impact Potential: Currently Michigan landfills have ~140 Mw of generating capacity. With proper policies and regulations to encourage more we estimate a 10% increase of 14 additional Mw. 14 Mw per year would be 7943 Mt of CH₄ or 198,585 MTCO₂e. This represents yearly electrical usage of 36,070 homes.

Works Cited

- Ellen Macarthur Foundation. (2019). *Completing the Picture: How the Circular Economy Tackles Climate Change*. Ellen Macarthur Foundation.
- Geisendorf, S., & Pietrulla, F. (2018). The circular economy and circular economic concepts— a literature analysis and redefinition. *Companies in the Circular Economy*, 771-782.
- Resource Recycling Systems. (2019). *Michigan Recycling Economic Impact & Recycled Commodities Market Assessment*. Michigan Department of Environment, Great Lakes, and Energy.

Appendix

Decarbonization Through Food Waste

Source Reduction

Overview of recommendation (250 word limit).

Michigan should establish a coordinated and comprehensive food waste reduction plan, focused first on source reduction, that supports the joint USDA and USEPA goal to reduce food loss and waste by half by the year 2030. Achieving this goal should align with the United National Sustainable Development Goal 12.3. The plan should draw on the ReFED Road map to 2030 and food waste reduction guidance published by the United Nations Environment Programme (UNEP).

1. In what timeframe is this recommendation achievable?

2025 Plan is in place and is being executed

2. What is the relative magnitude of this recommendation, in terms of GHG emissions reductions?

Reducing food waste by 50% results in removing 2,244,451 metric tons of CO₂e annually. In 2019, Michigan generated an estimated 1,087,332 tons of food waste. The current management system for this material adds approximately 509,542 metric tons of CO₂e annually. An additional 3,979,360 metric tons of CO₂e emissions are added each year to produce that 1,087,332 tons of wasted food. This results in total annual emissions of 4,488,902 metric tons of CO₂e associated with generating wasted food in Michigan.

Describe the potential impacts of this recommendation on environmental justice (250 word limit).

Preventing food from becoming waste makes that food available to feeding the hungry.

Increasing demand for food suppliers that are more aligned with local culture, demand, and preferences could increase support for local agriculture and support food sovereignty.

Provides equitable opportunity for all Michigan residents to participate in decarbonization.

3. Describe the potential impacts of this recommendation on labor (250 word limit).

Source reduction at retail establishments will require additional training of workers.

4. Describe the potential impacts of this recommendation on the environment (250 word limit).

Source reduction removes greenhouse gasses associated with transporting wasted food.

Source reduction potentially reduces fertilizer demands resulting in less nutrient runoff into Michigan surface water.

Reduces use water used for agricultural irrigation.

Reduces transportation emissions associated with transporting food that will be wasted.

5. Describe the potential impacts of this recommendation on economic development (250 word limit).

Food waste source reduction reduces costs for individuals and businesses. This money can then be circulated into the economy elsewhere.

6. What are the relative costs of this recommendation?

The cost of a plan is minimal

The cost of implementing the Plan is unknown but likely on the order of millions of dollars.

For example, the plan might include changes made to how food is packaged to better align with consumer consumption and food storage patterns which could have a minimal cost. It might include a statewide consumer awareness marketing campaign that could cost more than \$10 million or the development of sector wide technical assistance that could cost less than \$1 million. these activities that cost this amount form expensive to free remedies

7. Who is empowered to implement this recommendation?

With the initial focus on the plan development all organizations engaged in food systems, including growers, manufactures, distributors, retailers, consumers, and end of life managers will have a role. Additionally state, local government and federal partners will need to play a coordinating and policy leadership role.

8. Is there consensus among the subgroup for this recommendation, or are there differing perspectives? If differing perspectives, what are they? (250 word limit)

Use as opportunity to convey small tensions that add context or disagreements.

This recommendation must be implemented to achieve decarbonization in Michigan, as the focus should initially be on source reduction, there may be alternative food diversion opportunities to accelerate decarbonization with Composting and Anaerobic Digesters/Alternative Energy.

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Anaerobic digesting and composting pose environmental and regulatory challenges in the near term but are likely major contributors to food waste decarbonization in the long run.

9. What are the most important considerations for achievability and feasibility of this recommendation (500 word limit)?

Private sector engagement and investment and broad stakeholder involvement in the plan development are key.

Decarbonization Through Material Reuse

10. Overview of recommendation (250 word limit).

Michigan should develop a comprehensive, coordinated material reuse effort that creates and incentivizes a robust reuse industry. Doing so will acknowledge reuse as a central tenet of sustainability and a significant climate change mitigation strategy.

The term "reuse" means to extend the life of a product, package, or resource by using it more than once with little to no processing, repairing it so it can be used longer, and/or sharing, renting, selling, or donating it. This definition excludes materials used as a fuel substitute and energy production.

Our choices as consumers have a significant impact on climate change. There's a process behind every product that we buy, use and ultimately reuse, recycle or throw away. Energy is required during each step along a product's life – from raw material extraction, manufacturing, transportation, purchase, use and finally to disposal.

How much we consume has a direct impact on the amount of greenhouse gas emissions that are produced. When we buy more and new products, our consumption sets off a chain of events that produce greenhouse gas emissions, from extracting raw materials for the manufacture of products to the amount of waste to be managed when we no longer want them. Fewer greenhouse gases are produced when we [prevent waste](#) by buying less, reusing items or buying goods and services that have less impact on the environment.

Specific attention should be given to the following materials

- Textiles - *One ton of reused textiles saves more than 3 million gallons of water, 1,318 pounds of fertilizer, and 391 ounces of pesticides.*
- Batteries
- Building Material - *At least 11% of total carbon emissions (worldwide) come from building construction, most of which is embodied in the materials used to complete projects.*

11. In what timeframe is this recommendation achievable?

- by 2025
- by 2030
- by 2035
- by 2040
- by 2045
- by 2050
- after 2050
- multi-step process, not applicable or unknown (250 words max for explanation)

Actual achievement date is unknown and likely correlates with level of state investment.

12. What is the relative magnitude of this recommendation, in terms of GHG emissions reductions?

According to the Reuse International organization, the reuse community currently lacks a standardized mechanism to capture and disseminate critical information about the industry's triple bottom line impacts. These impacts include, but are not limited to, environmental impact (tons diverted from the waste stream, GHG avoided), economic impact (quantity of green jobs created, tax revenues and deductions, avoided purchase costs, etc.) and social impact (number of low-income families assisted, etc.). The State of Michigan has an opportunity to be a leader in supporting the collection, interpretation, and dissemination of such critical information).

_____ metric tons of CO2 equivalent per year; _____ metric tons of CO2 equivalent **by 2030.**

_____ metric tons of CO2 equivalent per year; _____ metric tons of CO2 equivalent **by 2040.**

_____ metric tons of CO2 equivalent per year; _____ metric tons of CO2 equivalent **by 2050.**

Unknown _____ provide explanation (150 word limit)

13. Describe the potential impacts of this recommendation on environmental justice (250 word limit).

- The reuse industry results in a cleaner environment, a greener economy for communities, and a more equitable society.
- Secondhand retailers/thrift stores enhance the dignity and quality of life of individuals and families by helping people reach their full potential through education, skills training, and the power of work.
 - Habitat for Humanity volunteers – both on construction sites and in Habitat ReStores – have helped more than 600,000 families in need own decent, affordable homes.
 - Goodwill International – in 2020, Goodwill helped more than 9.8 million people train for careers in industries such as banking, IT and health care and get supporting services they needed to be successful — such as English language training, additional education, or access to transportation and childcare.

14. Describe the potential impacts of this recommendation on labor (250 word limit).

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- The Reuse Alliance organization represents over one hundred reuse organizations that employ 250,000 people and diverts 9.1 million pounds of waste from landfills every day. This is a small fraction of the actual impact of the reuse industry.
- Reuse creates jobs while reclaiming valuable natural resources.
- Repair jobs alone represent 3% of the American workforce.
- Reuse enhances the integrity of materials through imagination, creativity, and intelligence.

15. Describe the potential impacts of this recommendation on the environment (250 word limit).

- Reuse encourages innovative, low cost, flexible, and local solutions to waste management.
- To encourage more people to join the movement toward creating a cleaner environment and a greener economy, October 20 has been recognized as National Reuse Day. The day helps raise awareness about how much material Americans waste and how buying, using, or donating reusable, reclaimed and remanufactured products can make a difference.
- Reusing an item means that it continues to be a valuable, useful, and a productive item, replacing the need for new items that would utilize more water, energy, timber, petroleum, and other limited natural resources in their manufacture.
- By reusing usable and salvageable items, substantial decreases in solid waste generation, greenhouse gases, energy and water consumption, and pollution can be achieved.

16. Describe the potential impacts of this recommendation on economic development (250 word limit).

- A robust reuse industry fosters increased opportunities for local economic development, including employment opportunities and community resiliency.

17. What are the relative costs of this recommendation?

\$ _____ per year; \$ _____ total by 2050

Unknown, or different timeframe – explain why (150 word limit):

18. Who is empowered to implement this recommendation?

Multiple sectors working independently and across platforms to develop a robust and sustainable material reuse industry within and throughout the State.

- Local government
 - Provide zoning and tax incentives for reuse facilities and retail establishments, encourage and sponsor reuse programs and special events
 - Prioritize zero-waste for public events
 - Recognize, support, and encourage participation on October 20th as National Reuse Day
- State government
 - Provide technical assistance, education and outreach, industry coordination, and policy leadership
 - Promote reuse by developing and maintaining listings of ongoing reuse activities, thrift stores, building reuse stores and architectural salvage
 - Maintain the Michigan Materials Marketplace as a facilitated transaction platform for reuse of industrial and commercial salvageable material
 - Support the Right to Repair Movement with appropriate policy/legislation
 - Encourage, support and sponsor zero-waste events
 - Support material reuse strategies identified by the Reuse Alliance organization and Reuse International organization, including the support, sponsorship, and implementation of training such as “Master Reuse” training.
 - Recognize, support, and encourage participation on October 20th as National Reuse Day
- Private sector
 - Offer and provide economic incentives for used/repurposed material in projects; support and promote environmental benefits of material reuse; create and support a culture of reuse; offer and implement reduction strategies.
- NPO/Charity
 - Develop networks for job rehabilitation in the reuse industry

19. Is there consensus among the subgroup for this recommendation, or are there differing perspectives? If differing perspectives, what are they? (250 word limit)

20. What are the most important considerations for achievability and feasibility of this recommendation (500 word limit)?

As it applies to GHG emissions associated with all the goods and services consumed within the State, consideration of a Consumption-based GHG inventory or carbon “footprint”, which includes the emissions associated with the production of goods or services imported into the region, would be useful to estimate the “embodied” or “life cycle” emissions associated with the production, transport, sale, use and disposal of goods and services consumed. This is based on the idea that consumers who benefit from these goods and services bear some responsibility for the associated emissions. This additionally provides insights on how consumer choices affect global GHG emissions far beyond the State’s border.

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References:

<https://www.epa.gov/smm/recycling-economic-information-rei-report>

<https://irp-cdn.multiscreensite.com/6f2c9f57/files/uploaded/zero-carbon-action-plan-exec-summary.pdf>

<https://nerc.org/news-and-updates/blog/nerc-blog/2014/03/11/reuseit-deserves-more-attention!>

<http://reusealliance.org/>

<http://www.reuseinstitute.org/>

<https://www.ecocycle.org/zerowaste/climate>

<https://www.repair.org/>

Decarbonization Through Organics Waste Diversion to Composting and Anaerobic Digesters

21. Overview of recommendation (250 word limit).

Michigan should establish a coordinated effort to support municipalities and the private/commercial sector to implement remedies such as compost facilities and anaerobic digesters to divert large amounts of food waste and other organic materials from landfills while also creating energy and revenue from these activities.

22. In what timeframe is this recommendation achievable?

- by 2025 - State regulatory (Part 115 amendments) and educational programs in place to guide development and operation of these facilities.
- by 2030 - Cities in Michigan with population over 100,000 have or are installing food waste composting or anaerobic digestion (producing energy for the city).
- by 2035 - Cities in Michigan with population over 50,000 have or are installing food waste composting or anaerobic digestion (producing energy for the city).
- by 2040 - Many Michigan Townships/Counties have large compost facilities or network of smaller facilities to divert food waste. Either owned and operated to generate revenue for the municipality or contracted to a third-party operator that will generate compost for profit. Some municipalities will find anaerobic digesters a feasible option for diversion and energy production based on local organic diversion opportunities. The organics diversion options will be enough to support the population that generates the waste.
- by 2045 - All Michigan Townships, Counties, and smaller municipalities will be educated on and actively seeking food waste diversion and energy recovery options (example – heating DPW buildings with heat collected from the composting of collected leaves and diverted food waste).
- by 2050 - Michigan residents will have access to food waste collection/diversion/recycling. Whether this is curbside pick-up or drop off locations depending on the area.
- after 2050 - Food waste and organic inputs into landfills will have dropped dramatically, therefore making them safer for the environment (less leachate) and increasing their longevity. Methane production in most landfills will have dropped significantly, leading to greenhouse gas reduction from landfills.
- multi-step process, not applicable or unknown (250 words max for explanation)

23. What is the relative magnitude of this recommendation, in terms of GHG emissions reductions?

_____ metric tons of CO2 equivalent per year; _____ metric tons of CO2 equivalent **by 2030.**

_____ metric tons of CO2 equivalent per year; _____ metric tons of CO2 equivalent **by 2040.**

_____ metric tons of CO2 equivalent per year; _____ metric tons of CO2 equivalent **by 2050.**

Unknown _____ provide explanation (150 word limit)

40% of all food generated in the United States ends up in landfills. With diversion and energy recovery resources available for all Michigan Citizens, the sky is truly the limit. Currently, it is hard to put numbers on the potential because there is a lot of capacity that is not being utilized to divert food waste in Michigan (multiple factors on why not). Would need precise data from multiple composters and anaerobic digesters taking food waste and compare to their populations to begin to assess the CO2 equivalents and potential for the future. That said, food waste in landfills can be a significant source of Methane/greenhouse gas production. Please see tables at the end of this document for estimations of CO2e reduction from food waste diversion based on the EPA's WARM model.

24. Describe the potential impacts of this recommendation on environmental justice (250 word limit).

There are currently multiple landfills around the state that have odor issues, leachate issues, both, and more. These can lead to health issues for nearby residents along with a reduction in enjoyment of life and property, as well as potential long term environmental issues. A significant drop in organics at a landfill decreases the production of methane and other greenhouse gases that also contribute to odors. Also, organics are water based and are a major source of leachate production in landfills. A reduction in leachate is beneficial to human health and the environment, as well as to the landfill itself.

Landfills can cause home values to drop in their immediate surroundings. Therefore, it is often lower income families that are most impacted by landfills choices at a greater proportionality. Reducing leachate hazards and odor emissions would greatly improve the quality of life for the neighbors of Michigan's landfills.

Advances in environmental justice can be achieved by prioritizing efforts to implement compost procurement policies in municipalities of cities/towns with large populations of

people disproportionately impacted by negative environmental factors that can be mitigated with the use of compost.

Making finished compost more accessible in cities experiencing increased incidences of high heat and flash flooding can support development of local solutions to improve environmental conditions. It can also increase those cities' capacity to adapt to the impacts of climate change.

25. Describe the potential impacts of this recommendation on labor (250 word limit).

Organics/food recycling/composting tend to create more jobs than landfills. The investment of these systems will not only help to create jobs and put money into the economy, but they can help save local governments and businesses money (over time).

EGLE staff will need to develop education and outreach material to inform Michigan's businesses, municipalities, and residents on the benefits of diverting their organic wastes to anaerobic digestors or composters. EGLE staff will assist in the training of municipal leaders on these benefits to encourage residents to find options for their organic waste. Once municipalities are trained/educated, they will be able to better assist their residents – limiting the labor and workload on EGLE staff.

26. Describe the potential impacts of this recommendation on the environment (250 word limit).

See #4. Reduction in food waste/organics in landfills ultimately leads to less odors/greenhouse gases, less leachate production, and less potential for fires/other hazards at the landfill. Composting pulls carbon out of the atmosphere and traps it into the final product that is then added back to the soil where it belongs. This is called Carbon Sequestration. Although Anaerobic Digesters don't sequester as much carbon, they do harness the energy from the organics that should have been harnessed in their original intended purpose. Digesters also can create fertilizers that will help reduce the dependency on chemical fertilizers that cause algae blooms in the Great Lakes.

27. Describe the potential impacts of this recommendation on economic development (250 word limit).

This will also likely create new businesses, generating new tax revenue at the local, state, and federal levels. Reduction in the amount of waste going to landfills could also potentially force those companies to enter the recycling market to generate revenue. This would in turn create new jobs and reduce the cost of recycling.

28. What are the relative costs of this recommendation?

\$_____ per year; \$_____ total by 2050

Unknown, or different timeframe – explain why (150 word limit):

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This will depend on how big and how well a “Food Waste Diversion Web” is created throughout Michigan. The cost to EGLE may be more up front if EGLE can offer grant opportunities to get businesses and municipalities started down this path to create forward movement that will result in others seeing the benefits and following suit on their own. Also, EGLE and others will need to spend money on targeted education campaigns to help reduce potential contamination (other wastes) that would end up in the diverted food waste and therefore increase the cost of food waste diversion.

29. Who is empowered to implement this recommendation?

- Local government
 - appropriate zoning for composting and anaerobic digestors
- State government – Executive
 - Provide technical assistance, education and outreach, industry coordination, and policy leadership
- State government – Legislative
 - Support and pass the Part 115 amendments that will help for the regulatory and program framework to help make all this possible.
 - Lead in the efforts to Organics Diversion for job creation and a healthy climate/environment for all of Michigan’s citizens and visitors.
- Federal government – Executive
 - Provide leadership, national coordination, and develop information and other tools
- Federal government – Legislative
 - Re-evaluate and re-implement tax and other incentives for businesses and municipalities to invest in Organics Diversion/Energy Recovery technologies.
- Private sector
 - Be full partners, collect and share food waste/organics related data, and implement reduction strategies. The private sector includes food producers, food manufacturers, and consumers
- Other (150 word limit):
 - There is a role for trade associations to assist with coordination, policy development, and training

30. Is there consensus among the subgroup for this recommendation, or are there differing perspectives? If differing perspectives, what are they? (250 word limit)

Although this recommendation is a must for decarbonization in Michigan, source reduction of food waste and other organic wastes must be worked on in tandem with Composting and Anaerobic Digesters. Reducing waste at the source will also have major impacts on carbon reduction in the atmosphere.

Composting and anaerobic digesters pose environmental and regulatory challenges in the near term. This can be worked on, but source reduction is a long term goal/solution for decarbonization.

31. What are the most important considerations for achievability and feasibility of this recommendation (500 word limit)?

Promote source reduction and diversion of food waste: Food waste is the most prevalent material found in Michigan Municipal Solid Waste. It is a prime candidate for organics waste diversion to composting and anaerobic digestion. As an alternative, feeding the hungry is a universally positive diversion opportunity.

Based on a 2016 economic impact potential and characterization of municipal solid waste in Michigan conducted by West Michigan Sustainable Business Forum, food waste comprises 13.6 percent of the municipal solid waste stream and other organics comprise 9 percent. EPA estimates have determined the national average to be higher. The decomposition of food waste and other organics that are not diverted/recovered contribute to greenhouse gas emissions as well as other potential local environmental hazards. By dramatically reducing this waste stream, Michigan can have a significant impact on the reduction of Carbon production and even sequester carbon back out of the atmosphere and into the soil.

Elements that should be considered include

Develop a model procurement policy* for Michigan to guide purchase and use of compost in public and private projects

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Anaerobic Digester WARM Model Estimates

Year	Percent Diverted Through Anaerobically digested	Metric Tons of CO2e Reduced Annually
2021	0.0%	-
2022	1.0%	5,978
2023	2.0%	11,955
2024	3.0%	17,933
2025	4.0%	23,911
2026	5.0%	29,888
2027	6.0%	35,866
2028	7.0%	41,843
2029	8.0%	47,821
2030	9.0%	53,799
2031	10.0%	59,776
2032	11.5%	68,743
2033	13.0%	77,709
2034	14.5%	86,676
2035	16.0%	95,642
2036	17.5%	104,609
2037	19.0%	113,575
2038	20.5%	122,541
2039	22.0%	131,508
2040	23.5%	140,474
2041	25.0%	149,441
2042	27.0%	161,396
2043	29.0%	173,351
2044	31.0%	185,307
2045	33.0%	197,262
2046	35.0%	209,217
2047	37.0%	221,172
2048	39.0%	233,128
2049	41.0%	245,083
2050	43.0%	257,038
2051	45.0%	268,993

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Composting WARM Model Estimates

Year	Percent Diverted Through Compost	Metric Tons of CO2e Reduced Annually
2021	0.0%	-
2022	1.0%	6,352
2023	2.0%	12,704
2024	3.0%	19,057
2025	4.0%	25,409
2026	5.0%	31,761
2027	6.0%	38,113
2028	7.0%	44,466
2029	8.0%	50,818
2030	9.0%	57,170
2031	10.0%	63,522
2032	11.5%	73,051
2033	13.0%	82,579
2034	14.5%	92,107
2035	16.0%	101,635
2036	17.5%	111,164
2037	19.0%	120,692
2038	20.5%	130,220
2039	22.0%	139,749
2040	23.5%	149,277
2041	25.0%	158,805
2042	27.0%	171,510
2043	29.0%	184,214
2044	31.0%	196,919
2045	33.0%	209,623
2046	35.0%	222,328
2047	37.0%	235,032
2048	39.0%	247,736
2049	41.0%	260,441
2050	43.0%	273,145
2051	45.0%	285,850

Decarbonization Through Circular Economy

32. Overview of recommendation (250 word limit).

Michigan should work to continue to grow our circular economy where waste materials are returned to their highest and best use so that Michigan achieves a 45% recycling rate and materials efficiently find their way from the curb to a new product made here in Michigan. Growing Michigan's Circular Economy and tripling our recycling rate avoids more than 10,355,618 MTCO₂E annually.

Michigan's Circular Economy should be supported by:

- 1) Growing local and statewide recycling markets
- 2) Improving the efficiency of Michigan's collection and processing infrastructure
- 3) Taking a systems approach to ensuring all materials are utilized rather than disposed.

33. In what timeframe is this recommendation achievable?

- This recommendation is achievable through a phased approach where Michigan achieves a 30% recycling rate in 2029 through the implementation of benchmark recycling standards as well as other funding and technical assistance support. A 45% recycling rate is achievable by 2034 through a combination of policy and funding support.

34. What is the relative magnitude of this recommendation, in terms of GHG emissions reductions?

10,355,618 MTCO₂E metric tons of CO₂ equivalent per year by achieving a 45% recycling rate. More reductions are possible if the goal is exceeded.

Achieving a 45% recycling rate will eliminate the equivalent emissions of an additional 7 million metric ton equivalent of carbon dioxide beyond current diversion practices -equivalent to taking nearly 1.5 million passenger vehicles off the road for one year or conserving the annual energy consumption of more than 760,000 households (approximately 20% of Michigan households).

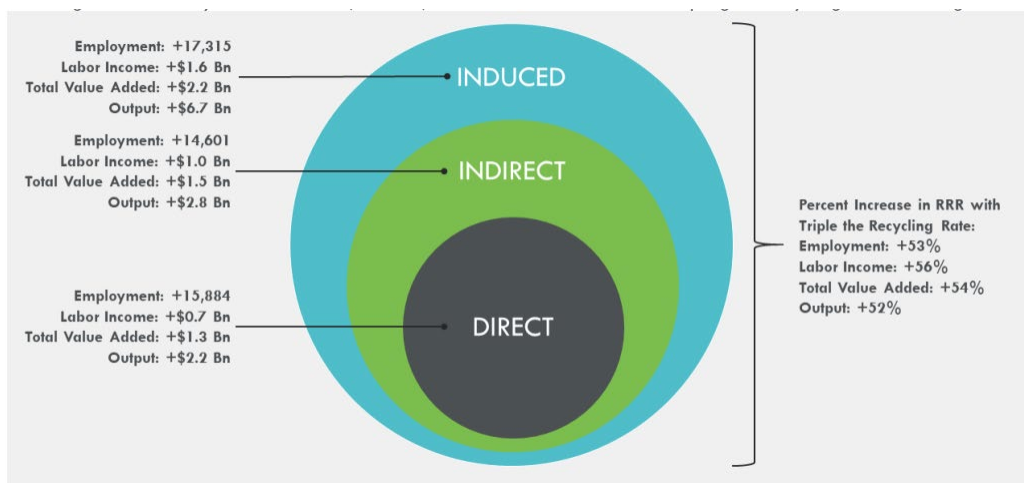
35. Describe the potential impacts of this recommendation on environmental justice.

Growing Michigan's circular economy will disproportionately positively impact communities where waste disposal is currently negatively impacting air, land, and

water. Circulating materials in the economy, rather than sending them on a one-way trip to a hole in the ground will not only result in mitigation of the impacts of Michigan’s marginalized communities but also will provide positive impact to communities where waste is transformed into the raw materials Michigan businesses need to make new recycled content products.

36. Describe the potential impacts of this recommendation on labor

The economic impact of tripling the recycling rate to 45% would support 138,000 new jobs in Michigan’s Recycling, Reuse & Recovery Industry, providing \$9 billion in annual labor income and \$33.8 billion in economic output. At a 45% recycling rate, the RRR industry would account for 3.3% of Michigan’s total economic output, overtaking Michigan’s transportation and tourism output. If all jobs that are directly, indirectly, or induced because of the recycling and recovery sectors were in the same city, it would be the third largest city in the state.



37. Describe the potential impacts of this recommendation on the environment

Growing Michigan’s Circular economy has direct positive impacts on Michigan’s environment. The most obvious and recognizable impact is on the reduction of

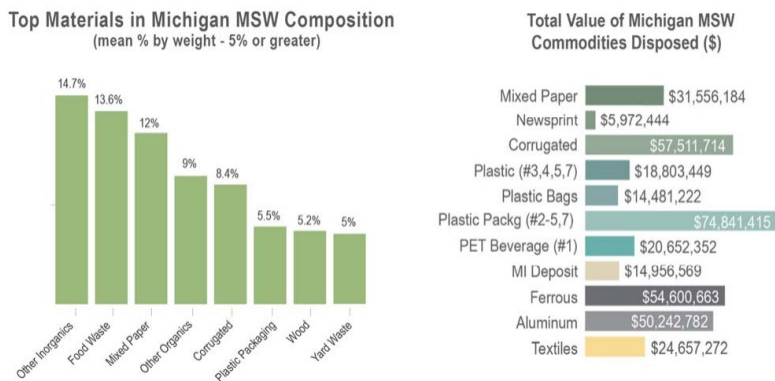
the disposal of waste materials in Michigan’s air, land, and water. Reducing the amount of waste that future generations will need to monitor, and cleanup will have an immediate positive impact. However, creating a domestic supply chain of raw materials for manufacturing will have an even greater impact. Growing Michigan’s circular economy will result in reduced pressure on our finite natural resources like land, water, minerals, and fuel. Rather than mining or harvesting natural resources, by creating systems that are truly circular, Michigan’s manufacturers and growers will have access to the natural resources that are needed for local, sustainable food systems, advanced manufacturing, and product development. Details can be found here

https://www.michigan.gov/documents/egle/egle-mmd-Michigan-Market-Development-Final-Report_678214_7.pdf

38. Describe the potential impacts of this recommendation on economic development.

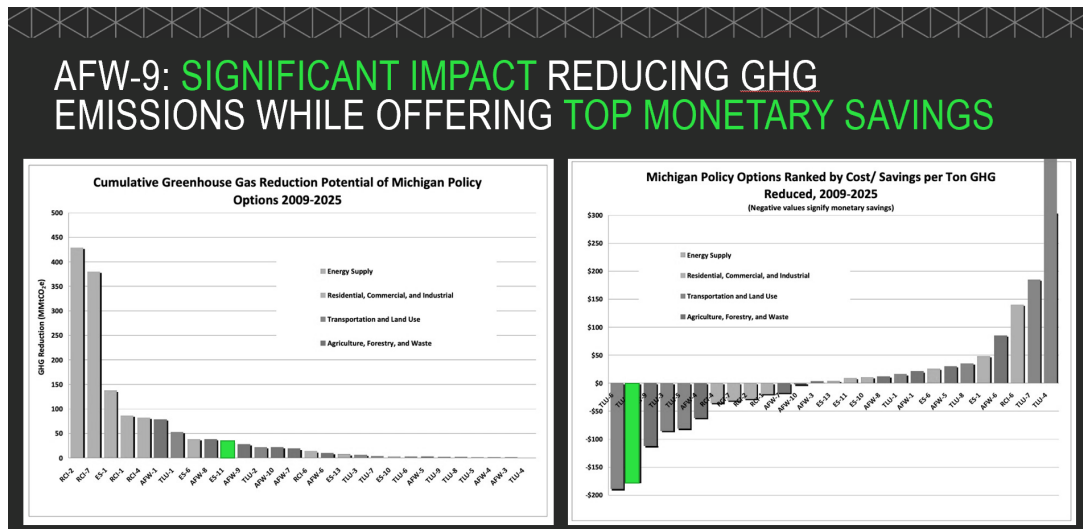
The most unique and impactful characteristic of Michigan’s circular economy is the accompanying benefits of economic development while protecting the environment. Take for example the fact that \$368M of valuable resources are landfilled in Michigan each year. By capturing this value, Michigan will not only see positive economic impacts but will at the same time realize positive climate impacts. Supporting data can be found here

https://www.michigan.gov/documents/deq/480236-14_WMSBF_waste_characterization_report_521920_7.PDF



39. What are the relative costs of this recommendation?

As was recognized in Michigan’s 2009 Climate Action Plan, Michigan’s Circular Economy has one of the most favorable economic benefits when carbon impacts verses economic impacts are compared. While circular economy efforts have an overall modest climate impact, their economic impact is nearly unmatched, leading to a strong return on investment.



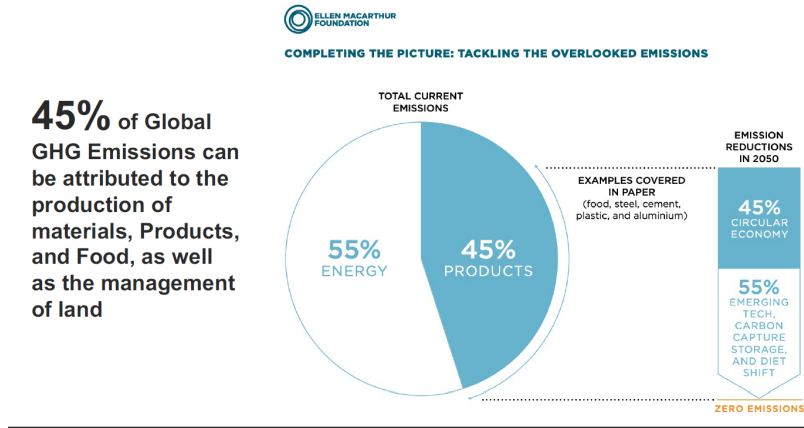
40. Who is empowered to implement this recommendation?

All levels of government have the potential to realize the positive economic and environmental impacts of growing Michigan’s circular economy. While the strongest leverage points are at the local level, with contracting and local policy having the greatest impact, State level leadership in policymaking is growing in importance. Currently Michigan has the policy tools needed to make a significant impact and federal and State level policy interventions will only accelerate action. Most of the effort needed is at the individual consumer and business decision level. Local governments and businesses are currently empowered to make the necessary changes to grow Michigan’s circular economy.

- Local government – contracting for collection and processing services.
- State government – Executive implementation of policies to encourage leading by example with state government procurement
- State government – Legislative Implementation of policies to level the playing field and encourage investment, as well as ensuring a consistent funding source for leveraging public investment in the Circular Economy system.
- Federal government – Executive - Leadership and funding.
- Federal government – Legislative Policy structure and funding.
- Private sector most of the investment in Michigan’s circular economy is currently coming from the private sector as manufactures recognize the importance of capturing materials for their manufacturing processes. Likewise, the private sector is responding to consumer demand for more sustainable products and desire for a solution to the growing waste problems in aquatic environments.

41. Is there consensus among the subgroup for this recommendation, or are there differing perspectives? If differing perspectives, what are they?

There is consensus in the subgroup that some of Michigan’s most achievable impact is in the Materials Management and Circular Economy space. It is recognized by subgroup members that materials management and recycling offer significant early wins as Michigan works toward climate neutrality.



42. What are the most important considerations for achievability and feasibility of this recommendation?

The most important considerations are encompassed by the continued need to maintain investment in Michigan’s Circular Economy. Significant progress is being made at the local and state level. Sending the signal that 1) growing Michigan’s circular economy is having strong, measurable results and 2) there are environmental justice, economic and environmental benefits to circular economy efforts that are resulting in real positive climate impacts, will allow leadership to capitalize on existing investments all the while having even more significant positive climate impacts.