

Economic Impact of The Detroit Climate Action Plan

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I. Executive Summary

In 2011, Detroiters Working for Environmental Justice (DWEJ) convened the Detroit Climate Action Collaborative (DCAC) as a partnership between non-profit groups, businesses, governmental organizations, and educational institutions in Detroit. In October 2017, the DCAC produced the Detroit Climate Action Plan (DCAP), which identifies a set of specific goals to reduce greenhouse gas emissions in Detroit, as well as potential actions by government, business, and residents to accomplish those goals. While the main purpose of this plan is to join a growing movement of local communities taking action to reduce greenhouse gas emissions, it is also possible to look at each action from another perspective: its effect on economic activity in the city.

PURPOSE OF REPORT

The purpose of this report is to identify a set of well-defined action plan steps in the Detroit Climate Action Plan, and to examine the potential economic impact of each on the city of Detroit.

OVERVIEW OF APPROACH

We define *net economic impact* as the amount of economic activity that occurs in a well-defined region due exclusively to the actions taken under the plan. Importantly, the net economic impact does not include *all* economic activity—only the economic activity that would not have happened otherwise and does not replace other local spending, employment, or development.

For each proposed action in the action plan, we:

1. Assess whether the action plan provides enough detail and specificity to allow evaluation at this stage of the process. For example, action steps that include making further, specific plans at a later date may result in actions that affect the city's economy, but are not possible to evaluate at this time.
2. Identify what types of impact each action would have, such as additional spending, increased productivity, and increased property values.
3. Identify the best existing studies on the economic impacts of these actions on the communities that pursue them.
4. Estimate the net economic impact on Detroit if the action is pursued, where possible.
5. Discuss the potential for economic impact from the action item when a quantitative estimate is not possible.

See “Appendix A. Methodology” on page A-1 for further discussion.

OVERVIEW OF FINDINGS

1. The Detroit Climate Action Plan includes over 100 action steps, many of which defy easy economic analysis ahead of time—and that’s a good thing.

The Detroit Climate Action Plan includes action steps from different work groups focusing on solid waste; public health; parks, public spaces, and water infrastructure; homes and neighborhoods; and businesses and institutions. While a top-down approach that specified the schedule, extent, and funding sources for each action ahead of time would make economic estimates easier, the DCAP reflects a more flexible approach focused on establishing partnerships, setting goals, and setting the stage for deeper collaboration. The result is an action plan that sets principles, identifies institutions to work with, and includes many plans for knowledgeable stakeholders to work together and make a more detailed plan.

In our view, this approach has several advantages from an economic perspective. First, it does not impose wide-ranging regulations or mandates that could force city residents, businesses, schools, and other institutions to change their behavior without further discussion and coordination. This approach has the potential to ensure the ultimate actions taken do the most good, make the most sense, impose the lowest cost, and do not adversely impact quality of life for residents. A second advantage is that the plan is not focused on high-profile “white elephant” projects that involve large expenditures but dubious returns.

One consequence of this approach, however, is that most of the specific decisions that result in tangible expenditures and behavior changes—the decisions that would allow systematic analysis that quantifies the economic impact of the action plan as a whole—have yet to be made. As a result, this report focuses on identifying the types of economic impacts that will occur when further action is taken, and on quantifying the impact of the specific action plan steps that have enough detail to allow a rigorous analysis.

2. We have identified 11 specific action plan steps by governments, businesses, and households that would have a clear impact on the Detroit economy. Many of these steps would directly increase spending on goods and services in the city or free up funds by reducing energy costs. Increased spending and reduced energy costs would result in increased employment and earnings in Detroit.

Steps in the action plan that would have an economic impact would either attract funding from outside entities to increase spending at Detroit businesses, or result in energy savings for Detroit residents and businesses that could then be reinvested in the city. Table 1, “Summary of DCAP Action Steps,” on page 4 shows the detailed impacts of the 11 action steps in the city.

Many of the action steps that will result in an economic impact in Detroit represent an investment in the city's green infrastructure (bike lanes, buildings, parks, and homes). Investments derived from funds outside of Detroit (such as foundations, the federal government, state government, or corporations) result in net new economic activity. The new spending involved in these investments will have direct impacts because these investments require labor and materials from the local region. In addition, this spending will circulate through the local economy as suppliers and workers spend money locally.

In addition to the impact of new investment, the energy savings resulting from certain investments produce an economic impact. In Michigan, the energy sector supply chain relies on suppliers outside of Michigan. As a result, the multipliers for spending on energy are relatively small. If Detroit households, public sector organizations, and private sector organizations spend less on energy, they will spend more on other, higher multiplier purchases in Detroit. This impact is depicted in Figure 1 below.

FIGURE 1. How Green Infrastructure Investment Impacts Detroit's Economy

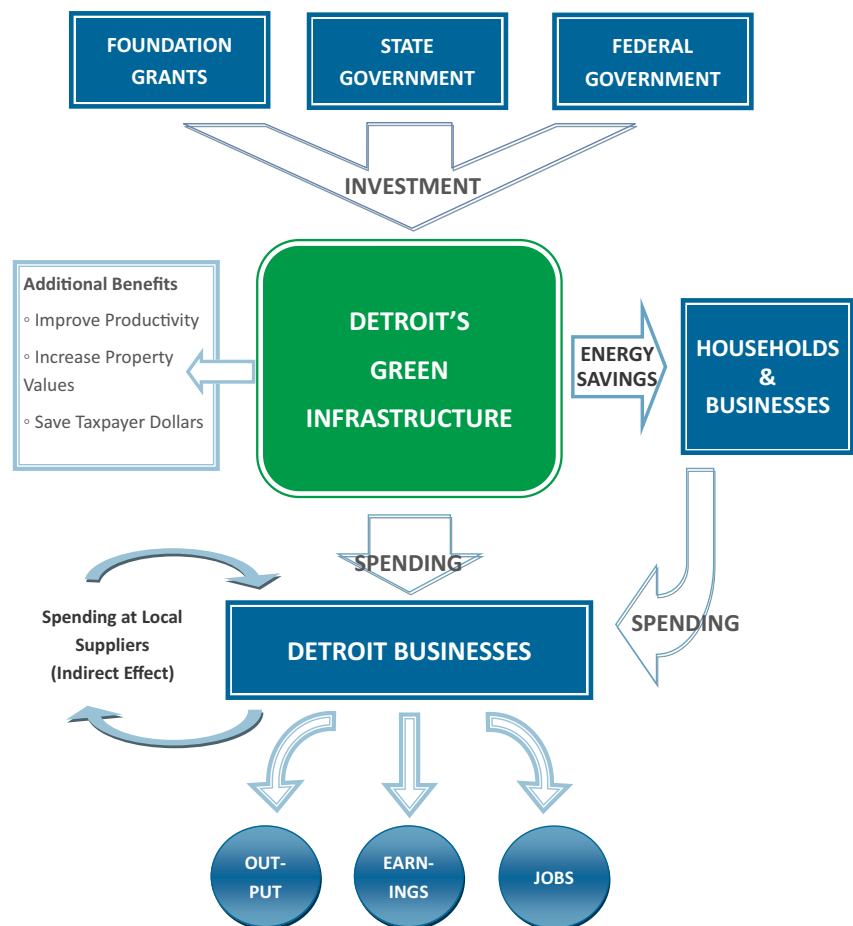


Table 1: Summary of DCAP Action Steps

	Action Steps	Funding	Economic Impact ^a	Costs	Benefits			
					General Public	Homeowners	Businesses	Taxpayers
Actions taken by Government	Planting Trees	City of Detroit, with possible access to state, federal, and private foundation grants.	Each additional tree planted and maintained would result in \$164 and \$11 in economic output, respectively; each 689 trees planted would create a new job in Detroit.	Planting a tree costs \$220 on average, while maintaining a tree planted on a public street costs \$22 per year.	A single 20-inch-diameter ash tree could result in \$157 in benefits each year, and a similar elm tree could result in \$181; planting trees improves air quality and creates maintenance job opportunities.	A 20-inch ash tree will raise property values by \$63 per year; a similar elm tree will raise it by \$109 per year.	Higher property values and better air quality lead to healthier, more productive employees.	Savings of approximately \$21 per year in stormwater runoff and \$20 per year in electricity per tree planted.
	Creating Bike Lanes	City of Detroit, with possible access to state and federal grants.	The total economic impact from creating a mile of conventional bike lane and buffered bike lane would be \$2,191 to \$16,764 and \$5,280 to \$24,631, respectively; each 7 to 81 miles of bike lane would result in a new job in Detroit.	Conventional bike lanes can cost \$4,400 to \$33,500 while buffered bike lanes can cost \$10,500 to \$50,000; other costs could include increased congestion.	Biking leads to more active, healthy residents.		Making it easier for residents to bike will lead to healthier, more productive employees.	
	Opening New Parks	City of Detroit, with possible access to federal funding to demolish abandoned properties.		Costs can vary greatly depending on the location and size of park; small parks cost as little as tens of thousands with large parks ranging from \$90 million to \$400 million.	Abandoned areas can become beautiful open spaces.	Types of park land generally considered under this plan will raise property values, but the magnitude of the effect is unknown.	Large park events can bring in tourists and new consumers.	Large parks have the option to include revenue-generating amenities; greater home values lead to a larger property tax base.
	Improving Bus Infrastructure	City of Detroit, with possible access to state and federal grants.	Building or maintaining an improved bus shelter would result in \$387 to \$11,624 in economic output; each additional 16 to 120 bus shelters built would result in a new job in Detroit.	Improving shelters could cost \$2,000 to \$15,000 initially, and \$500 to \$30,000 annually to maintain; costs depend on funding, materials, and labor.	An improved bus system will increase ridership.		New shelters present new advertisement opportunities; greater transportation will lead to more access to businesses.	Coordinating bus routes can result in lower costs and higher revenues.
	Salvaging Material	City of Detroit, with possible access to federal funds to rehab blighted areas.	Deconstruction would give rise to new business opportunities and increase exports of salvaged material.	Deconstruction is often more expensive than demolition. Deconstruction costs an estimated \$10.08 per square foot and demolition costs \$7.75 to \$9.30 per square foot.	Sale of salvaged materials could replace importing materials from other locations.		Opportunities for firms to specialize in deconstruction.	
	Green Tourism	Varies	Promoting green tourism would attract spending by new visitors to the city.	Can require large investment in improving public spaces.	Becoming a model city for greenhouse gas reduction improves Detroit's image.	A better image makes Detroit a more attractive place for future homeowners to live.	Brings in tourists and new consumers.	
Actions taken by Businesses	Retro-fitting Buildings	Businesses or institutions	The economic impact would depend on the source of the funding and the nature of retrofits.	Costs vary depending on how much is being updated and how old the building is.			If a company could replace its lighting system for less than ~\$3.50 per bulb it would save money. Older structures could realize savings on heating.	Company energy savings could be reinvested in Detroit.
	Natural Lighting	Businesses or institutions		Costs can vary depending on if natural lighting is added to an existing building or considered in the construction of a new building.			Cost savings at 58 cents per square foot per year; studies show natural light increases productivity; creates a more desirable work space.	
	Green Roofs	Businesses or institutions	Installing a square meter of green roof would result in \$125 in economic output; each 907 square meters of installation would create a new job in Detroit.	Average costs of installation are \$167 per square meter.	New jobs created; better air quality; possible for fresh produce to be grown in the city.		Energy savings; opportunities to specialize in installation of roofs; healthier and more productive employees; greater property values.	Green roofs capture stormwater, reducing flooding and costs to sewer systems.
Actions taken by Households	Home Weatherizations	Households, with possible access to state or federal grants or loans.	Each weatherization project results in \$4,088 in economic output, on average; each 60 homes weatherized would create a new job in Detroit.	An average home weatherization costs \$5,100.	Creates new jobs.	Reduce energy consumption by 10% to 20%; increase property values by \$0 to \$5,400 per weatherized home.		
	Renewable Energy	Households, with possible access to state or federal grants or loans.	Switching to local renewable energy sources would result in savings from utility spending that could ultimately help local households and businesses.	Costs vary; labor is generally 10% of project costs.		Energy produced by a solar cell saves households and companies money by reducing the amount of energy they buy from the grid; a 3 kW system will cut the average home electricity bill in half.		

Source: AEG Analysis based on DCAP Action Steps

Note: a. The economic impact estimates are calculated based on an assumption that 50% of program funding would come from sources outside of Detroit.

3. Detroit can leverage federal, state, and private foundation funding to finance the implementation of DCAP action steps. This net new spending from outside sources will spur economic activity and create new jobs in Detroit.

It is possible for Detroit to leverage grants from outside the city to finance the implementation of DCAP action steps. These funds may be able to offset some or all of the costs of this investment, and result in new investments in Detroit businesses and increased employment for Detroit residents. For example, if a grant supports half of the cost, we estimate that each additional tree planted in the city will spur approximately \$160 to \$180 in additional output at Detroit businesses. The table below summarizes the estimated output and employment impacts from implementing five of the action steps.

TABLE 2. Impacts of DCAP Action Steps in Detroit^a

Action Step	Impact on Output by Detroit Businesses	Scale of Project to Create One Job in Detroit
Planting Trees	\$164 per tree planted \$11 per tree maintained	689 trees
Creating Bike Lanes ^b	\$2,191-\$24,631 per mile	7-81 miles
Improving Bus Shelters	\$1,550-\$11,624 per shelter	16-120 bus shelters
Installing Green Roofs	\$125 per square meter	907 square meters
Home Weatherization	\$4,088 per home	60 homes

Source: Anderson Economic Group Analysis using cost estimates from multiple academic studies and industry reports (see "Appendix C. Literature Review" on page C-1)

a. The economic impact and job impact are estimated based on an assumption that 50% of program funding would come from sources outside of Detroit.

b. The range includes the impacts from creating a mile of conventional and buffered bike lanes.

4. Several action steps would have other economic benefits, including lowering operating costs, improved productivity, and higher property values.

In addition to the economic impact resulting from investment and cost savings, the action plan also will produce other economic benefits that we did not quantify. These include increased property values, changes in productivity, and improvements in Detroit's image as a green city. Figure 2 on page 6 summarizes the additional benefits from implementing each action step we analyzed.

For instance, a home with solar technology installed is valued at approximately \$15,000 more, on average, than a similar home without. Increasing urban forests and parks and access to quality public transit increase property values, as

well. Natural lighting improves productivity of workers. Research suggests that the productivity increase has a larger monetary effect than the energy savings.

Finally, investing in green infrastructure could produce economic benefits in the form of attracting new talent to the city, improving the reputation of the city, and potential green tourist attractions.

Balancing the total costs and benefits is not the purpose of this report, but these additional factors are potentially more important than the effects we were able to quantify in estimating economic impacts and should be considered in addition to environmental benefits and health benefits.

FIGURE 2. Additional Benefits from Implementing DCAP Action Steps



Source: Anderson Economic Group analysis of DCAP action steps

LIMITATIONS

Our analysis provides an independent look at the direct economic consequences for many of the specific action items in the action plan. There are some limitations to our approach:

- We do not attempt to assess the economic consequences for Detroit caused by climate change, or its potential mitigation through these efforts.
- We do not attempt to assess the trade-offs involved in pursuing action plan tasks that could affect convenience, quality of life, or institutional capacity (e.g., resources and attention of management) of households, businesses, or governments. Many of the action plan tasks could have positive or negative effects on each in ways that are not captured by the approaches we identified for assessing each item.

**ABOUT ANDERSON
ECONOMIC GROUP**

Anderson Economic Group, LLC, is a boutique research and consulting firm, with offices in East Lansing, Michigan; Chicago, Illinois; and New York, New York. The experts at AEG specialize in economics, public policy, business valuation, and industry analyses. They have conducted nationally-recognized economic and fiscal impact studies for private, public, and non-profit clients across the United States.

The experts in the Public Policy and Economic Analysis practice area at AEG have particular expertise in evaluating energy policy, economic impacts, and environmental policy in the Great Lakes region. See “Appendix D. About AEG” on page D-1 for more information.

II. Actions Taken by Government

In order to reduce greenhouse gas emissions, the Detroit Climate Action Plan calls for the city government of Detroit to fund additional infrastructure and green spaces. In this section, we review action steps from the Detroit Climate Action Plan that the City would assume principal responsibility for. These actions include planting trees, creating bike lanes, opening new parks, improving bus infrastructure, promoting salvaging material, and supporting green infrastructure tours. Some of the actions will require shifting budget priorities, increasing taxes, or leveraging grants and funding from state, federal, and private sources.

ACTIONS SPURRING NEW SPENDING IN DETROIT

Some of the potential actions taken under the Detroit Climate Action Plan will require additional government investment in Detroit. These investments will increase spending and employment in Detroit. The extent of this economic impact will depend on the extent to which Detroit can access outside funds to support these investments. In many cases, federal and state programs can supplement local funds to bring additional money into the city.

Planting Trees

The City of Detroit would assume principal responsibility for several action steps. One proposed action step is to increase the urban canopy of Detroit.¹ Additional trees reduce stormwater and electricity usage, improve air quality, and increase property values.

The benefits and costs of planting a tree can vary substantially depending on size and type. According to a case study by American Forests, a national non-profit conservation organization, elm and ash trees are among the most common types of trees in Detroit.² The national tree benefit calculator, developed by Casey Trees and Davey Tree Expert Co., estimates that an ash tree 20 inches in diameter planted in a downtown Detroit commercial business zone can provide \$157 in benefits on environment and home values each year.³ An elm tree with a similar spread would provide \$181 in benefits each year.

1. See Goal 1 in “Parks, Public Spaces, and Water Infrastructure,” Detroit Climate Action Plan.

2. American Forests, “Detroit Case Study,” *Urban Forests Case Studies*, 2012, p. 92-99.

3. National Tree Benefit Calculator, <http://www.treebenefits.com/calculator/treeinfor.cfm?zip=48201&city=DETROIT&state=MI&climatezone=Northeast&country=US>, accessed on August 1, 2016.

The model takes into account benefits from reduction in stormwater runoff, electricity usage, carbon dioxide level, as well as improvement in air quality and property value.

According to research conducted jointly by the USDA Forest Service and University of California, planting a tree costs \$220 on average and maintaining a tree planted on a public street costs \$22.33 per year.

Depending on the availability of state, federal, or private programs, Detroit may bring in funding from outside the city to finance its tree planting projects. An example would be the DTE Energy Foundation Tree Planting Grant, which matches local tree planting spending at a 1-to-1 ratio.⁴ Utilizing the grant will offset half of the cost that the City will bear, and we estimate that the net new spending will increase output at Detroit businesses by \$164 and \$11 for each tree planted and maintained, respectively, in Detroit. In addition, we estimate that each 689 trees planted will create a net new job in Detroit.

Building Bike Lanes

Dedicated bike lanes require large investments by the City.⁵ The cost depends heavily on the details of each project. Converting current lanes for cars, expanding roads, the type of bike lane created, the length of bike lanes—all of these decisions will impact the costs and benefits. A mile of conventional bike lane costs between \$4,400 and \$33,500, while a mile of buffered bike lane costs between \$10,500 and \$49,200.⁶

Buffered bike lanes are safer, which should increase usage and provide greater benefits. However, they may require expansion of roads, greatly increasing the cost. In some instances adding a bike lane will increase congestion.

TABLE 3. Impacts from Creating Bike Lanes

Type of Bike Lane	Impact on Output by Detroit Businesses	Scale of Project to Create One Job in Detroit
Conventional	\$2,191-\$16,764 per mile	11-81 miles
Buffered	\$5,280-\$24,631 per mile	7-34 miles

Source: Anderson Economic Group Analysis using cost estimates from Lynn Weigand, Nathan McNeil, and Jennifer Dill, "Cost Analysis of Bicycle Facilities: Cases from cities in the Portland, OR region," 2013.

The City of Detroit may be able to use state and federal infrastructure grants to pay for the creation of bike lanes as part of larger road infrastructure improvement projects. We estimate that these investments would spur additional eco-

4. Michigan Department of Natural Resources, "DTE Energy Foundation Tree Planting Grants." http://www.michigan.gov/dnr/0,4570,7-153-30301_40936_74679_74684-125033--,00.html, accessed on October 20, 2017.

5. See Goal 3 in "Homes and Neighborhoods," Detroit Climate Action Plan.

6. Lynn Weigand, Nathan McNeil, and Jennifer Dill, "Cost Analysis of Bicycle Facilities: Cases from cities in the Portland, OR region," 2013.

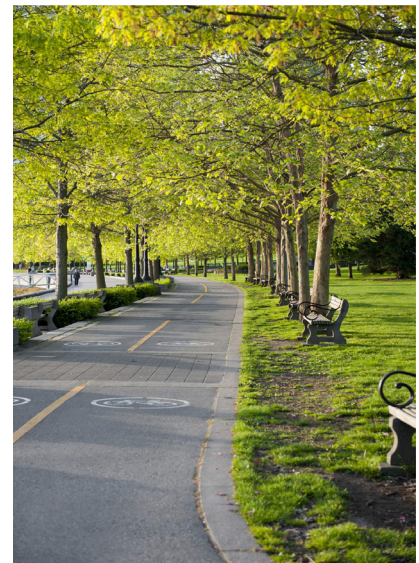
conomic activities and create new jobs in the city. Table 3 on page 9 details the estimated economic impact in Detroit due to new bike lane construction if 50% of the construction cost is supported by outside sources.

Opening New Parks

The main economic impact of any new park land will depend on the value of the land itself.⁷ The City may need to acquire the land, then convert it from a property that may generate revenue to a non-revenue generating site. Alternatively, the City may choose to build a park on a piece of unmaintained or unused land that the City owns or acquires, creating a new use for the vacant land. The cost to the City will depend on the use the land is zoned for, the location and surrounding neighborhood, and the cost to convert the land to a park. Smaller neighborhood parks can cost as little as tens of thousands of dollars, while large waterfront park systems in Atlanta, Boston, Chattanooga, and Cincinnati have cost between \$88 million and \$400 million.⁸

These larger parks often include revenue-generating amenities, such as concert shells. They can be rented for large-scale events, such as festivals. If these larger parks hold events that bring in tourists or suburban residents, they would represent a net benefit to the city. It is uncertain if benefits from tourism or other amenities would offset the large costs of the parks without further details.

Several federal programs exist to assist cities in creating and expanding parks. For instance, the Land and Water Conservation Fund, administered by the National Park Service, provides matching grants to state and local governments to fund recreation plans.⁹ Another example is the Community Development Block Grant program, which offers some limited funding for local parks and recreation.¹⁰



*A city park
(Image Credit: "Vancouver city, Canada," used
under license from Shutterstock.com.)*

7. See Goals 1 and 2 in "Parks, Public Spaces, and Water Infrastructure," Detroit Climate Action Plan.

8. Riverlife, "Three Rivers Park: Economic Impact Analysis," 2015.

9. The Land and Water Conservation Fund Coalition, "LWCF Program," <https://www.lwcfcoalition.com/lwcf-programs/>, accessed on October 16, 2017.

10. Walls, "Parks and Recreation in the United States," *Resources for the Future*, June 2009.

Improving Bus Infrastructure

The creation of local bus routes connected to main bus routes should increase ridership.¹¹ The measure has proven to be especially successful when cities improve and construct shelters at bus stops.¹² An analysis of bus shelters in Salt Lake City, Utah, concluded that, depending on the location, amount of use, and quality of the shelter, it would cost the city between \$2,000 and \$15,000 to build a shelter, and between \$500 and \$30,000 to maintain it.¹³ These estimates do not include any advertising space the city might sell to reduce costs.

The specifics of any project will have different costs and benefits, as well as economic impacts depending on the sources of funding, materials, and labor. If we assume that the same cost estimates from Salt Lake City would also apply in Detroit and the city would be able to fund 50% of the improvement project with outside funding, building an additional bus shelter would have an economic impact of \$1,550 to \$11,624, while maintaining a bus shelter would have an economic impact of \$387 to \$23,249. In addition, we estimate that each additional 16 to 120 bus shelters built would result in one net new job in the city.

Salvaged Materials

There are several ways in which salvaging materials could have a positive economic impact in Detroit.¹⁴ The sale of salvaged materials could replace importing materials from other locations, increasing spending on construction materials at local businesses. The salvaged materials could also be exported, which would have a similar effect. Finally, an emphasis on salvaged materials could kickstart a sector of firms specializing in deconstruction and salvage. These firms could then export their services to nearby regions, bringing in additional revenue and employing more workers.

These benefits depend on the global demand for salvaged materials. In 2004, the Institute for Local Self-Reliance published a report that estimated the demand for several types of deconstructed material in the greater Philadelphia area. They estimate that salvaged lumber could sell for 26 cents per board foot. They also estimate that bricks sold for 35 to 40 cents per brick. But they note that poor material renders many salvaged bricks unfit for use, and that consumers may need to spend 70 to 80 cents per usable brick. Other architectural features may be salvaged and sold as well, which include tiles, doors, bathtubs, iron gates, window covers, cabinets, radiators, light fixtures, marble thresholds, and windows.

11. See Goal 3 in “Homes and Neighborhoods,” Detroit Climate Action Plan.

12. Transportation Research Board, “Report 46, Part 2, Impacts of Amenities,” March 30, 2014.

13. Memorandum from Russell Weeks to Salt Lake City Council, September 19, 2006.

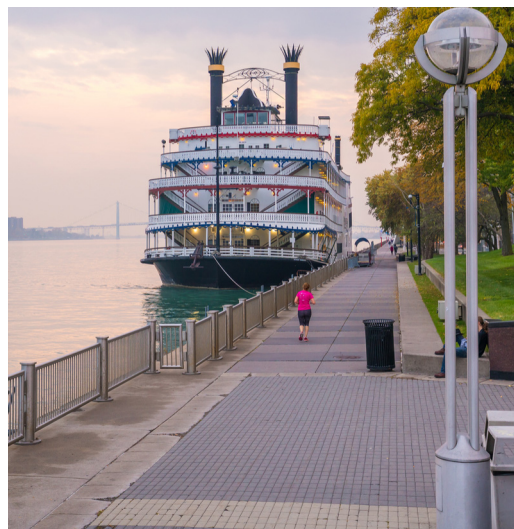
14. See Goal 5 in “Homes and Neighborhoods,” Detroit Climate Action Plan.

Separately from the value of salvaged material, the study notes that deconstruction is more expensive than demolition. It estimates the net cost of deconstruction to be \$10.08 per square foot, while net cost of demolition is \$7.75-\$9.30 per square foot.¹⁵

Despite the higher cost, several deconstruction initiatives have gained momentum in Detroit, including a citywide demolition program funded mostly through federal Hardest Hit Fund (HHF) dollars.¹⁶ Alongside a number of tasks to remove urban blight, the program encourages deconstruction of abandoned properties rather than straight-out demolition. Deconstruction efforts in Detroit have provided new business opportunities, created jobs, and reduced landfill waste, bringing economic gains to the city.

Green Infrastructure Tours

The Detroit Climate Action Plan is, in part, an effort to create a model for cities around the world to follow. New investment and improvement in public space could improve Detroit's image, resulting in more tourism. Effects of this are speculative at best as it is impossible to know how much more tourism will occur in Detroit as a result of the Detroit Climate Action Plan. Nonetheless, if Detroit experiences an increase in tourism, it will improve Detroit's economy by bringing new spending to the city.



*View of downtown Detroit riverfront
(Image Credit: "View of Downtown Detroit riverfront in Michigan USA," used under license from Shutterstock.com.)*

ACTIONS THAT IMPROVE OPERATIONAL EFFICIENCY

Some action steps would lower the cost of operations for Detroit city government and provide taxpayer savings. This would be achieved through economies of scale, cost-saving investments, and more.

15. Neil Seldman and Brenda Platt, "Finding Value in Recovered Building Materials," Pennsylvania Department of the Environment, March 22, 2012.

16. City of Detroit, "Detroit Demolition Program," <http://www.detroitmi.gov/demolition>, accessed on October 25, 2017.

Planting Trees

Planting trees will absorb rainwater, reducing sewerage costs and maintenance costs for city infrastructure.¹⁷ Trees also absorb heat that would otherwise warm the surrounding air and buildings in the summer, and block wind to reduce heat loss in the winter. These effects reduce the energy needed to heat and cool, resulting in operational efficiencies. The same 20-inch ash and elm trees discussed in “Planting Trees” on page 8 will result in an estimated \$20.80 and \$22.12 in savings to stormwater systems per tree, respectively, each year. Each tree planted near a building will also yield an estimated \$19.40 and \$20.48 in electricity savings, respectively, per tree per year.¹⁸ These savings would exceed the maintenance cost of the trees, which is \$22.33 per year as shown in “Planting Trees” on page 8, and result in a net gain to businesses and households in the city.

Coordination of Bus Routes

Coordinating bus routes could result in lower costs and more ridership.¹⁹ With lower costs and higher revenues from ridership, Detroit’s transit system should have extra money to work on other projects that could improve ridership in a cost-effective manner or provide savings to taxpayers in state and local government that subsidize public transit.

Determining if and to what extent Detroit can improve its transit system is outside the scope of work for this report.

ACTIONS THAT IMPROVE PRODUCTIVITY

Healthier residents will perform better while at work and have fewer sick days. Implementing action steps that promote Detroit residents’ health will improve the Detroit economy.

Building Bike Lanes

Building bike lanes can result in more residents biking around the city, which will increase physical activity for Detroit residents and improve public health.²⁰ As a result of better health, Detroiters could become more productive employees and have lower health costs.

17. See Goal 1 in “Parks, Public Spaces, and Water Infrastructure,” Detroit Climate Action Plan.

18. National Tree Benefit Calculator, <http://www.treebenefits.com/calculator/treeinfor.cfm?zip=48201&city=DETROIT&state=MI&climatezone=Northeast&country=US>, accessed on August 1, 2016.

19. See Goal 3 in “Homes and Neighborhoods,” Detroit Climate Action Plan.

20. Ibid.

ACTIONS THAT INCREASE PROPERTY VALUES

Some action steps would increase the value of property in Detroit. Increasing property values will help increase the wealth of Detroit property owners and generate additional property tax revenue for the city.

Planting Trees

Planting new trees will increase the “curb appeal” of homes.²¹ In Detroit, planting an ash tree 20 inches in diameter in front of a single home is estimated to boost the value of the property by \$63, on average, while a 20-inch elm tree will raise it by \$109.²²

Building New Parks

A study done on homes in suburban communities near Boston found that homes near open spaces achieved an average appreciation rate roughly two percentage points per year higher than homes located farther away from open spaces.²³ Another study using residential sales data from Maryland measured the effects of different types of open spaces on property values, in general, and found desirable types of open spaces, such as conservation lands and non-military open space, raise property values, while undesirable types, such as military land, have an insignificant effect.²⁴ The types of park land envisioned in the Detroit Climate Action Plan will raise property values, but the magnitude of the effect is unknown without further information about the location and scope of the parks.

21. See Goal 1 in “Parks, Public Spaces, and Water Infrastructure,” Detroit Climate Action Plan.

22. National Tree Benefit Calculator, <http://www.treebenefits.com/calculator/treeinfor.cfm?zip=48201&city=DETROIT&state=MI&climatezone=Northeast&country=US>, accessed on August 1, 2016.

23. Jeff Lacy, “An Examination of Market Appreciation for Clustered Housing with Permanent Open Space,” Center for Rural Massachusetts, 1990.

24. Elena G. Irwin, “The Effects of Open Space on Residential Property Values,” *Land Economics*, vol. 78, iss. 4, November 2002, p. 465-480.

III. Actions Taken by Businesses and Institutions

In this section of our report, we review the action steps under the Detroit Climate Action Plan that require investments by businesses in the city. These actions include retrofitting buildings, adding natural light, and installing green roofs. Given that businesses are a key part of the coalition creating the Detroit Climate Action Plan, it is likely that many of these actions will be done without the need for regulations that might otherwise have an adverse impact on business recruitment and retention in Detroit.

ACTIONS SPURRING NEW SPENDING IN DETROIT

Several action steps require that businesses make investments in Detroit.²⁵ Insofar as these investments would not have otherwise occurred in Detroit (in other words, “net new” investments), these investments will result in a positive economic impact. The amount of spending that would be net new will vary from project to project. Companies often make investments by using profits or leveraging future profits. As a result, the amount of spending that is net new to Detroit will depend on the primary source of revenue for a company and what else the company could have invested in.

Companies like General Motors that make money internationally will have a larger impact in Detroit if they choose to retrofit their buildings because money from sales outside the city that might have been spent elsewhere would instead be directed toward investment in the city. On the other hand, retrofitting the building of a company that relies on local customers and has fewer opportunities to spend the money outside of Detroit will have a lower impact, because the company was already likely to invest in the city.

Retrofitting Buildings

The Detroit Climate Action Plan calls for retrofitting buildings. Complete building retrofits ensure that all components of a building including electrical systems, lighting systems, heating/cooling systems, and physical weatherization are up to date. The cost of a retrofit can vary depending on how much spending is required. While retrofits at older buildings tend to cost more, they also tend to result in greater energy savings.

As an example of how retrofitting offices could result in a positive investment, the Department of Energy estimates the annual energy costs of 60-watt traditional light bulbs are \$4.80 per bulb, 15-watt compact fluorescent bulbs are \$1.20 per bulb, and 12-watt LED bulbs are \$1.00 per bulb.²⁶ If a company could

25. For this chapter, see “Businesses and Institutions,” Detroit Climate Action Plan.

replace its lighting system for less than \$3.50 per bulb it could save money. Those savings could then potentially be invested in Detroit.

Natural Lighting in Office Buildings

Adding natural lighting can be part of a retrofit of a current building or can be incorporated in new construction. More natural lighting tends to result in a higher construction cost, but also higher rental income.

Green Roofs

Green roofs or living roofs are roofs that contain plants and vegetation instead of solely concrete. A study on the costs of green roof installation at the University of Michigan estimated that the average cost of installing a green roof is \$167 per square meter.²⁷ Green roofs represent an investment in the building infrastructure, as green roofs reduce heating and cooling costs for the building. By spending the money on additional roofing materials instead of energy, money goes to city contractors rather than energy companies that may locate outside the city.



*An example of green roof installation
(Image Credit: "Rooftop garden outdoor on soft focus," used under license from Shutterstock.com.)*

Several federal grant sources are available for energy efficiency and renewable energy projects.²⁸ Most of these grants are administered by state and local governments, and provide financial assistance to green infrastructure projects, which include green roof installation. While the funding allocation is

unclear and may depend on applicants, these grants can potentially offset portions of the installation costs borne by Detroit businesses, and result in net new spending in the Detroit economy. Using the cost estimate above and an assumption that half of the cost is funded by a federal or state grant, we estimate that the economic impact from installing a square meter of green roof is \$125, and

26. United States Department of Energy, <http://energy.gov/energysaver/how-energy-efficient-light-bulbs-compare-traditional-incandescent>, last accessed August 1, 2016.

27. Coorrie Clark, Peter Adriaens, and F. Brian Talbot, "Green Roof Valuation: A Probabilistic Economic Analysis of Environmental Benefits," University of Michigan, April 10, 2006.

28. United States Environmental Protection Agency, "Green Infrastructure Funding Opportunities," <https://www.epa.gov/green-infrastructure/green-infrastructure-funding-opportunities>, accessed on October 20, 2017.

for each 907 square meters of green roof installation, there will be a net new job created in Detroit.

Green roofs must also be maintained. Maintenance spending could crowd out other investment that may have higher multiplier effects, so the economic impact of green roof maintenance is ambiguous and highly dependent on characteristics of the businesses that implement green roofs.

ACTIONS THAT IMPROVE OPERATIONAL EFFICIENCY

Some of the business actions in the DCAP will reduce operating costs for businesses, largely through energy savings. While these effects themselves do not always justify the initial investment (which is why businesses do not already pursue them without the DCAP), these savings will increase operating profits that businesses could use to fund other potential investments.

Retrofitting Buildings

The goal of building retrofits is to reduce energy consumption of buildings. Given the wide range in retrofitting projects, it is impossible to give an accurate estimate of the amount of energy savings. Older buildings will produce more savings, but often will require more investment.

Natural Lighting in Office Buildings

Natural lighting reduces operational costs because it requires less energy to light buildings with more natural light. In addition, the business will no longer need to purchase and maintain as many lights. This effect is relatively small compared to the additional costs of building in natural lighting. The American Council for an Energy Efficient Economy reports that, on average, buildings use 5.8 kilowatt hours per square foot per year.²⁹ Based on data from the Energy Information Administration, we estimate that commercial electricity costs 10 cents per kilowatt hour in Michigan. At 58 cents per square foot per year, anticipated cost savings are low.³⁰

Green Roofs

Green roofs reduce operational costs in a variety of ways. First, green roof technologies help capture stormwater. As a result, the Detroit sewer system can be operated with less money and the city and its residents face less flood risk. In addition, green roofs can reduce energy costs by blocking sunlight, keeping buildings cooler.

29. Jennifer Thorne and Steve Nadel, "Commercial Lighting Retrofits: A Briefing Report for Program Implementers," American Council for an Energy Efficient Economy, April 2003.

30. Business Leaders for Michigan, "2016 Economic Competitiveness Report," December 2016.

ACTIONS THAT IMPROVE PRODUCTIVITY

Several projects will improve Detroit's economy by improving the health of Detroit residents. Healthier residents perform better while at work and take fewer sick days.

Natural Lighting

Several studies have demonstrated that workers are more productive when their office is illuminated by natural light rather than artificial light.³¹ Increasing workers' well-being and productivity will generate increased economic activity for businesses already in Detroit, and make it a more desirable location for businesses not currently located in Detroit.

Green Roofs

Green roofs help remove air pollution from the local area. This reduction in air pollution results in healthier and more productive residents. In addition, green roofs (and other green spaces in the city) may be enjoyed as outdoor spaces for employees. A study showed that employees who took short breaks to look at green spaces were more constantly alert than their peers who looked at concrete.³²

ACTIONS THAT INCREASE PROPERTY VALUES

Natural Lighting

Natural lighting makes buildings less costly to operate and more desirable to work in. As a result, the value of properties with more natural lighting is greater than those with less natural lighting, all else equal.

Building Retrofits

Building retrofits result in energy cost savings. These savings will ultimately increase property values as retrofitted buildings are cheaper to operate and maintain. In addition, tenants may find retrofits more appealing, which may result in increased occupancy rates and rental income for property owners.

Green Roofs

Green roofs have a similar effect as building retrofits, but with less predictable results for property values. Some potential occupants may be willing to pay a premium for a green roof, while others will not. While the increased investment will likely increase property values, the increase may vary.

31. Jennifer Thorne and Steve Nadel, "Commercial Lighting Retrofits: A Briefing Report for Program Implementers," American Council for an Energy Efficient Economy, April 2003.

32. Kate Lee *et al.*, "40-second green roof views sustain attention: The role of micro-breaks in attention restoration," *Journal of Environmental Psychology*, vol. 42, p. 182-189, June 2015.

IV. Actions Taken by Households

In this section, we examine the action steps under the Detroit Climate Action Plan that require investments by residents of Detroit. These action steps cost money up front but in some cases will result in indirect impacts, lower future costs, and increased property values.

ACTIONS SPURRING NEW SPENDING IN DETROIT

Some of these action steps call for residents of Detroit to spend more money in the city. Increased spending will result in positive economic impact, if this additional spending would not have otherwise occurred in Detroit (in other words, if the spending is “net new” to the region). The amount of spending that is net new depends on the source of funds and potential use. For instance, if a household makes an investment using funds that would have been spent by the household in the city anyway, the economic impact would be small or potentially negative. In many of the action steps we describe below, we believe there will be at least some economic impact in the city because of federal and state funds available to help fund these types of projects.

Home Weatherizations

The Detroit Climate Action Plan encourages homeowners to improve energy efficiency through home weatherization.³³ Home weatherization often involves activities such as air sealing, improving ventilation, and adding insulation. In addition to energy savings, there are non-energy benefits associated with weatherization. According to the Office of Energy Efficiency and Renewable Energy, every \$1 invested in the federal weatherization assistance program will result in \$2.78 in non-energy benefits such as improved living conditions, fewer sick days, and decreased out-of-pocket medical expenses.³⁴

A recent study of a low-income weatherization program in Michigan found that an average weatherization project costs \$5,100.³⁵ It may be possible to leverage federal and state grants to bring new money into the state for weatherization. This spending from outside funds will spur economic activity and create new jobs in Detroit. The size of the impact will depend on the share of funds made available from outside sources. We estimate that, if the state and federal government provide 50% of weatherization costs in Detroit, each weatherization proj-

33. See Goal 1 in “Homes and Neighborhoods,” Detroit Climate Action Plan.

34. Office of Energy Efficiency and Renewable Energy, “About the Weatherization Assistance Program,” <https://energy.gov/eere/wipo/about-weatherization-assistance-program-0>, accessed on October 25, 2017.

35. Meredith Fowlie, Michael Greenstone, and Catherine Wolfram, “Do Energy Efficiency Investments Deliver? Evidence from the Weatherization Assistance Program,” Working Paper, June 2015.

ect will result in \$4,088 in increased output at Detroit businesses, on average, and that one net new job will be created per 60 weatherized homes.

Renewable Energy

While much of the direct spending on solar panels would not directly benefit Detroit businesses, it could result in savings from utility spending that could ultimately help local households and businesses.³⁶

It is likely that the actual renewable energy device, such as a solar panel, will not come from a supplier based in Detroit. The labor cost for installation, which will be provided by a Detroit company, is generally about 10% of the cost of a project.³⁷ As a result, Detroit will only experience a net positive direct impact from installing solar panels if much of the money used to purchase and install a solar panel is from outside the city.



*An example of solar panel installation
(Image Credit: "Solar panel on red roof reflecting," used
under license from Shutterstock.com.)*

However, renewable energy options will alter the indirect impacts of energy spending in Detroit. Energy spending already has little impact on the local area because power plants are not physically located in the area and the fuels for these plants are imported. Switching to local, renewable energy sources could result in more spending at businesses within the city.

ACTIONS THAT REDUCE HOUSEHOLD COST

Many of these projects also help households save money on energy costs and increase spending on other things. While these savings do not necessarily justify the initial investment (otherwise more homeowners would already be pursuing them), once the investment has been made, the households should benefit in terms of cost savings and potentially spend more at local businesses.

Home Weatherizations

Home weatherization projects help reduce household energy consumption by making homes more energy efficient. People rely on engineering estimates to determine the efficiency gains from weatherization. These engineering esti-

36. See Goal 1 in "Homes and Neighborhoods," Detroit Climate Action Plan.

37. R.K. Schwer and M. Riddel, "The Potential Economic Impact of Constructing and Operating Solar Power Generation Facilities in Nevada," Technical Report, 2004.

mates easily justify weatherization programs.³⁸ However, a recent study of a weatherization program in Michigan shows that the actual energy savings were less than half of the theoretical changes due to changes in energy use after adopting energy efficient technology. Even so, that study demonstrated that weatherized homes reduced energy consumption by 10% to 20%.³⁹

Renewable Energy

Once installed, solar panels reduce energy costs. The energy produced by a solar cell saves households money by reducing the amount of energy they buy from the grid. The average home uses 900 kWh of energy a month. A 3-kW solar panel system will replace half of that, cutting the average bill in half.⁴⁰

ACTIONS THAT INCREASE PROPERTY VALUES

The following action steps will reduce the costs of owning and maintaining properties in Detroit. As a result, we expect the values of those properties to go up. The increased property values can help households build wealth and generate more property tax revenue for the City of Detroit.

Home Weatherizations

The Oak Ridge National Laboratory estimates the benefits of weatherization and concludes that increased property values following weatherization offset the costs of installation.⁴¹ This evidence suggests that even if the cost of home weatherization is greater than expected energy savings, homeowners can benefit economically through an increase in home values. Moreover, since home weatherization pays for itself through lower energy costs and higher property value, any outside funding to weatherize homes in Detroit will result in an economic gain for the city.

Renewable Energy

Solar technology can add property value to homes. Studies have indicated that home buyers are consistently more willing to purchase a home with solar systems. One study has demonstrated that buyers are willing to pay a premium of \$15,000 for a home with average solar technology systems compared to a simi-

38. Joel Eisenberg, "Weatherization Assistance Program Technical Memorandum Background Data and Statistics," Oak Ridge National Laboratory Report, March 2010.

39. Meredith Fowlie, Michael Greenstone, and Catherine Wolfram, "Do Energy Efficiency Investments Deliver? Evidence from the Weatherization Assistance Program," Working Paper, June 2015.

40. Ibid.

41. Martin Schweitzer and Bruce Tonn, "Nonenergy Benefits from the Weatherization Assistance Program: A Summary of Findings from the Recent Literature," Oak Ridge National Laboratory Report, April 2002.

lar home without. This translates to an additional \$4 in property value per watt of solar power.

Appendix A. Methodology

In the following section, we provide a list of action steps analyzed under the Detroit Climate Action Plan and describe the methodology used to produce our estimates.

ACTION STEPS ANALYZED IN THIS REPORT

The Detroit Climate Action Plan identifies a set of 20 goals for government, businesses, and residents to address climate-related issues in the city. These goals are grouped in five sections: solid waste; public health; businesses and institutions; parks, public spaces, and water infrastructure; and homes and neighborhoods. See “Appendix B. The Detroit Climate Action Plan” on page B-1 for the full list of recommended actions.

We identified 11 action steps that are specific, detailed actions where a potential impact can be measured. Table 4 below details the list of goals and their corresponding action steps that we analyzed.

TABLE 4. DCAP Action Steps Analyzed by AEG

Section	Goal	Action Steps
Homes and Neighborhoods	Goal 1. Improve energy efficiency and durability of homes.	<ul style="list-style-type: none">• Natural lighting• Green roofs• Home weatherization
Homes and Neighborhoods	Goal 2. Improve and update the Detroit energy grid.	<ul style="list-style-type: none">• Renewable energy
Parks, Public Spaces, and Water Infrastructure	Goal 1. Protect, enhance, and quantify the benefits of carbon sinks.	<ul style="list-style-type: none">• Planting trees• Opening new parks
Homes and Neighborhoods	Goal 1. Improve energy efficiency and durability of homes.	<ul style="list-style-type: none">• Retrofitting buildings
Homes and Neighborhoods	Goal 3. Reduce dependency on cars as primary transportation.	<ul style="list-style-type: none">• Creating bike lanes
Homes and Neighborhoods	Goal 4. Encourage the use of new construction methods and technology through education.	<ul style="list-style-type: none">• Green tourism
Homes and Neighborhoods	Goal 5. Reduce waste from construction and demolition.	<ul style="list-style-type: none">• Salvaging material
Homes and Neighborhoods	Goal 3. Reduce dependency on cars as primary transportation.	<ul style="list-style-type: none">• Improving bus infrastructure

Source: Detroit Climate Action Plan

ESTIMATING THE COST AND BENEFIT OF DCAP ACTION STEPS

To estimate the costs and benefits of enacting elements of the action plan, we reviewed a number of academic studies and industry reports. For example, for the analysis of the action step about opening new parks, we referred to several case studies on large waterfront park systems in Atlanta, Boston, Chattanooga, and Cincinnati, and used their cost estimates as a range for the potential size of investment required from the City to open a park in Detroit. In addition, we used the National Tree Benefit Calculator, based on i-Tree’s street tree assessment tool, to estimate the projected benefits from opening new parks and planting

more trees in the city. See “Appendix C. Literature Review” on page C-1 for a detailed list of studies and sources we reviewed and used to inform our analysis.

ESTIMATING THE ECONOMIC IMPACT OF DCAP ACTION STEPS

To the extent possible, we estimated the economic impact of several action steps in the city of Detroit. In particular, we considered how additional funding from sources outside of the city would generate economic gain and create net new jobs in the city.

For example, to estimate the economic impact from constructing new bike lanes, we first used data from cities in Oregon to determine the costs of construction per mile. Then, we applied the RIMS II multiplier for the highways and streets industry in Wayne County to 50% of cost estimates because we estimate that half of the required investment will be leveraged from a source outside the city. This results in an estimate of the total economic impact from creating a mile of new bike lane in Detroit. We calculated the estimated economic impact on employment using a similar method with the RIMS II final demand employment multipliers for the highways and streets industry.

We applied a similar methodology to the analysis of planting trees, installing green roofs, improving bus shelters, and weatherizing homes. In particular, we used the multipliers for the “residential structures” industry for estimating the impacts of home weatherization, the multipliers for the “nonresidential structures” industry for bus shelter impact estimates, and the multipliers for “services to buildings and dwellings” industry for the green roof and tree planting estimates.

Appendix B. The Detroit Climate Action Plan

The Detroit Climate Action Plan includes the following goals and action steps. Note that we only estimated the impacts of a portion of these steps in our analysis for this report.

SOLID WASTE

Goal 1. Offer universal recycling and organic waste collection for everyone in Detroit: at home, work, businesses, events (80% by 2022).

Near-term action steps:

- Create a citywide community education program;
- Increase curbside recycling participation rate to 40%;
- Initiate household food waste collection demonstration projects;
- Implement 100% Zero Waste practices in municipal buildings;
- Encourage recycling in multi-family housing.

Long-term action steps:

- Increase participation in recycling, organic waste collection, and composting;
- Require waste contracts to employ Zero Waste methods;
- End City contract with Detroit Renewable Power (incinerator) by 2021;
- Recycling and Waste Reduction subcommittee of the Green Task Force evaluates City ordinances on construction and demolition waste.

Goal 2. Ensure that waste hauler contracts in 2019 align with the City Charter.

Near-term action steps:

- Communicate the importance of waste reduction and materials recovery to the financial health of the City to staff/administrators and City Council members;
- Recycling and Waste Reduction subcommittee of Green Task Force will lead development of waste minimization strategies;
- Add household composting to waste hauler contracts in 2019;
- Conduct education outreach in neighborhoods and with businesses.

Long-term action steps:

- Establish budget line item for information and education;
- Achieve a diversion rate of at least 35% by 2022, 70% by 2030, and Zero Waste (over 90%) by 2040;
- Establish contract terms for materials management that reflect priority of Zero Waste policies;
- Require recycling in all multi-family units by 2021.

Goal 3. Commit to Zero Waste and full implementation of the City Charter section 7-403.

Near-term action steps:

- Work with City officials to enforce mandate of materials recovery, prior to disposal, as stated in City Charter;
- Work with businesses to increase recycling;
- Ensure that infrastructure projects support waste reduction and materials recovery;
- Conduct outreach in neighborhoods and with businesses to provide education on waste recovery.

Long-term action steps:

- Track data on recycling and waste management to refine additional incentive programs;
- Update Charter if necessary;
- Align policy incentives for business initiatives to support waste reduction and recycling;
- Minimize landfilling and end incineration.

PUBLIC HEALTH

Goal 1. Inform decision makers and residents of Detroit about climate change health risks and evidence-based responses.

Near-term action steps:

- Promote practical emergency and community alert systems for extreme weather events and ozone action days;
- Create health promotion materials with climate adaptation and mitigation strategies;
- Build capacity for policy advocacy through community organizing networks;
- Establish baseline data on participants using citywide interventions and resources.

Long-term action steps:

- Update climate- and health-related interventions for residents and community groups, with focus on vulnerable populations;
- Implement policy changes consistent with shared goals and strategies;
- Consider innovative, sustainable, healthy, and equitable best practices;
- Centralize implementation of climate and health recommendations.

Goal 2. Ensure that citywide and agency emergency response plans address public health risks of climate change.

Near-term action steps:

- Conduct review of existing plans alongside vulnerability assessments (by 2020);
- Update emergency response plans to include resources and strategies indicated by the review (by 2025).

Long-term action steps:

- Ensure vulnerable populations are included in emergency response plans;
- Update heat and flooding vulnerability assessments to inform revisions of interventions.

Goal 3. Assess health impacts of land use decisions affecting urban heat islands, air quality, and stormwater management.

Near-term action steps:

- Ensure climate-related health metrics are included in the Detroit Master Plan;
- Train land-use professionals on climate-related health impacts and interventions;
- Train public health officials on land use planning process.

Long-term action steps:

- Identify and codify healthy and sustainable alternatives for traditional infrastructure such as transportation, stormwater, and wastewater systems;
- Establish a taskforce or board for conducting Health Impact Assessments of major land use developments, policies, or permitting decisions in Detroit;
- Standardize health impact assessment process for planners, developers, engineers, and the construction community.

Goal 4. Increase monitoring of climate-related health outcomes, such as heat-related hospitalizations, injury or death from extreme weather events, and asthma-related outcomes.

Near-term action steps:

- Educate healthcare providers and community planning staff on environmental triggers of disease to improve identification of climate change-related conditions (e.g., heat, ozone, pollen, and mold);
- Determine a baseline for climate and health educational materials provided by healthcare providers;
- Create a cross-sectoral communication strategy by 2020 with the goal of increasing variety and use of surveillance data that inform public health and healthcare provider practices along with decision making in City departments.

BUSINESSES AND INSTITUTIONS

Long-term action steps:

- Analyze data from Federally Qualified Health Centers (FQHCs), hospitals, and healthcare providers during extreme climate-related events (e.g., temperature, humidity, precipitation, flooding, and air quality).

Goal 1. Reduce greenhouse gas emissions among businesses and institutions, in the areas of transportation, energy, and the built environment (Baseline 2012 emissions: 10% by 2022, 30% by 2032, 80% by 2050).

Near-term action steps:

- Establish a Detroit greenhouse gas business index, a rating system to compare greenhouse gas emissions of each company by subcategories;
- Establish a Detroit business and institution climate coalition to recruit and engage businesses in the above-mentioned index;
- Establish a business-to-business model that provides incentives and engages external partners.

Long-term action steps:

- Demonstrate collective progress in all stated areas;
- Evaluate progress toward emission-reduction goals annually.

Goal 2. Create resilient institutions and a green business-to-business culture.

Near-term action steps:

- Promote the business Sustainability Toolbox;
- Highlight sustainable business practices that create economic value;
- Host an annual event to celebrate successes.

Long-term action steps:

- Expand the Detroit business and institution climate coalition;
- Evaluate, maintain, and improve the coalition vision, mission, and governance.

Goal 3. Preserve and conserve water quantity and water quality.

Near-term action steps:

- Engage with City of Detroit Water & Sewerage Department and stakeholders in the community;
- Establish training by retirees (possibly with the Retired Engineers Technical Assistance Program) for high school students to conduct energy and water audits;

-
- Develop strategies for stormwater management such as on-site green/blue infrastructure, rain gardens, and sustainable development.

Long-term action steps:

- Engage with City of Detroit Water & Sewerage Department and monitor progress annually;
- Revisit and revise goals and strategies every 2 years based on results and new developments;
- Support policy changes in how the Federal Emergency Management Agency floodplain data is used.

Goal 4. Increase awareness of career options in sustainable development.

Near-term action steps:

- Create a collaborative “societal” marketing campaign that includes: investing in public education with youth education, library programs; promoting career pathways in sustainability and climate change for all; and encouraging partnerships in career training.

Long-term action steps:

- Encourage schools to include sustainability themes in their curriculums;
- Evaluate, maintain, and improve marketing campaign.

PARKS, PUBLIC SPACES, AND WATER INFRASTRUCTURE

Goal 1. Protect, enhance, and quantify the benefits of carbon sinks.

Near-term action steps:

- Develop data-driven plan(s) and program(s) to increase tree canopy citywide;
- Develop a citywide green infrastructure plan to manage stormwater, filter pollutants, and improve public health.

Long-term action steps:

- Support new design efforts being led by the City of Detroit Planning & Development Department;
- Implement data-driven plan(s) and program(s) to increase tree canopy citywide;
- Increase opportunities for voluntary community maintenance of land;
- Daylight water systems, i.e., tributaries, streams, rivers, and wetlands.

Goal 2. Increase the resilience of ecosystem services.

Near-term action steps:

- Establish citywide ecosystem services inventory;
- Implement the City’s open space plan.

Long-term action steps:

- Expand, protect, and maintain environmental/ecological/natural resources and corridors that provide habitat value;
- Designate ecologically important areas as “permanent natural features”;
- Provide access to diverse recreational opportunities for all residents.

Goal 3. Prioritize investments to green infrastructure.

Near-term action steps:

- Continue to invest in DWSD’s asset management infrastructure;
- Develop a citywide green infrastructure plan that supports implementing storm-water management best practices.

Long-term action steps:

- Implement asset management plan;
- Implement green infrastructure plan.

Goal 4. Quantify how much and what kind of green infrastructure investment will improve water quality in the region.

Near-term action steps:

- Develop a citywide asset management plan for drinking and wastewater infrastructure;
- Develop citywide green infrastructure plan supporting stormwater management best practices.

Long-term action steps:

- Implement asset management plan;
- Implement green infrastructure plan.

**HOMES AND
NEIGHBORHOODS**

Goal 1. Improve energy efficiency and durability of homes.

Near-term action steps:

- Maximize Detroit Climate Ambassadors program;
- Provide information on energy efficiency, conservation with presentations in neighborhoods, at libraries and community centers;
- Partner with the school system on climate change education initiatives;
- Host home retrofitting training and weatherization workshops.

Long-term action steps:

- Build demonstration houses;

-
- Sponsor or coordinate programs for education and best practices for lowering energy bills;
 - Generate resources to replicate the home retrofitting and training project and bring it to scale.

Goal 2. Improve and update the Detroit energy grid.

Near-term action steps:

- Frequently collect data on the Detroit electric grid for performance and accounting;
- Establish micro-grids in neighborhoods with hospitals, universities, and municipal buildings as anchors;
- Work with utility companies to update transmission lines for distributed energy sources to move away from centralized power plants.

Long-term action steps:

- Continue to monitor energy usage;
- Expand micro-grids to include low income communities.

Goal 3. Reduce dependency on cars as primary transportation.

Near-term action steps:

- Encourage development of multimodal connections, such as bike storage at bus and light rail stations;
- Promote safe options for walking and biking, such as bikeshare and public events;
- Increase the convenience and reach of public transportation options.

Long-term action steps:

- Implement demonstration projects and promote existing ones such as greenways and Complete Streets;
- Encourage Complete Streets design for new development and redevelopment;
- Incentivize business development in underserved areas.

Goal 4. Encourage the use of new construction methods and technology through education.

Near-term action steps:

- Convene educational seminars for general contractors, architects, and professionals;
- Encourage green building accreditation, certification, audits, and reporting;

-
- Update building codes to support emerging technology and methods for reducing energy consumption;
 - Provide training for building inspectors such as credentialing and education;
 - Host a Detroit tour of green technology for City of Detroit Department leaders.

Long-term action steps:

- Include reporting by contractors on new construction methods and technology in Section 3 Plans;
- Create a homeowner operation and maintenance manual;
- Create municipal incentives to support new methods such as fast-tracking, bid points, reduced permitting fees.

Goal 5. Reduce waste from construction and demolition.

Near-term action steps:

- Advance a policy requiring salvaged material be used in major projects;
- Expand deconstruction activities and boost the market for reused, and products from salvaged, material;
- Provide training for building inspectors;
- Create opportunities for developers and realtors to come together to make the field of sustainability more mainstream in their respective businesses.

Long-term action steps:

- Research case studies and implement deconstruction best management practices;
- Award extra points in bid processes for having buildings third-party-certified for energy efficiency and sustainability;
- Create a reuse marketplace/website allowing consumers to browse residential and commercial reused building materials.

Appendix C. Literature Review

The following sources were used to inform our analysis and provide context to our research:

- Dough Banting et al, “Report on the Environmental Benefits and Costs of Green Roof Technology for the City of Toronto,” City of Toronto and Ontario Centres of Excellence–Earth and Environmental Technologies, October 2005.
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Appendix D. About AEG

Anderson Economic Group, LLC, is a boutique consulting firm founded in 1996, with offices in East Lansing, Chicago, and New York. Our team has a deep understanding of advanced economic modeling techniques and extensive experience in multiple industries in multiple states and countries. We are experts across a variety of fields in tax policy, strategy and business valuation, public policy and economic analysis, and market and industry analysis.

Anderson Economic Group has performed work on a number of environmental economics issues. Relevant publications from our firm include:

- *Analysis of Michigan's Options Under the EPA's Clean Power Plan*, published in 2016.
- *The Net Costs of a 25% Renewable Energy Mandate in Michigan*, published in 2012.
- *Aquatic Invasive Species in the Chicago Area Waterway System*, published in 2017.
- *The Costs of Aquatic Invasive Species to Great Lakes States*, published in 2012.

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- *Governments*: The government of Canada; the states of Michigan, North Carolina, and Wisconsin; the cities of Detroit, Cincinnati, and Sandusky; counties such as Oakland County and Collier County; and authorities such as the Detroit-Wayne County Port Authority.
- *Corporations*: Ford Motor Company, First Merit Bank, Lithia Motors, Spartan Stores, Nestle, and InBev USA; automobile dealers and dealership groups representing Toyota, Honda, Chrysler, Mercedes-Benz, General Motors, Kia, and other brands.
- *Non-profit organizations*: Convention and visitor bureaus of Lansing, Ann Arbor, Traverse City, and Detroit, and Experience Grand Rapids; higher education institutions including Michigan State University, Wayne State University, and University of Michigan; trade associations such as the Michigan Manufacturers Association, Service Employees International Union, Automation Alley, the Michigan Chamber of Commerce, and Business Leaders for Michigan.

Please visit www.AndersonEconomicGroup.com for more information.

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Mr. Horwitz is a Senior Consultant at Anderson Economic Group, and the Director of the Public Policy and Economic Analysis practice area. Mr. Horwitz has extensive expertise on state and local economic conditions and on the economic and fiscal impacts of public policy. He has provided research, analysis, and expert testimony on policy in a range of fields, including state and local

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Mr. Horwitz has advised governments, trade organizations, and corporations across the country on economic issues and the impacts of policy. His work also includes economic impact studies of universities, hospitals, museums, retailers, and large-scale events. His work has been featured in Bloomberg Businessweek, NPR Marketplace, Chicago Sun-Times, Detroit News, Crain's Chicago Business, and on WBEZ Radio.

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