2018

2018 Green Cincinnati Plan

CINCINNATI city of

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A WORD FROM THE MAYOR

Dear Friends,

It has become clear that cities will lead the global effort to fight climate change, and Cincinnati is on the front lines. My office has joined over 1700 other mayors in the Global Covenant of Mayors - a joint commitment to do our part to reduce our carbon emissions.   To make good on this commitment, we are leading the way by investing in renewables, with the construction of a 25-megawatt solar array - the largest city-owned solar installation in the country. This will serve as a major step toward our goal of 100% renewable energy for Cincinnati by 2035.

The world is taking notice. The Green Cincinnati Plan has helped us set measurable targets and identify strategies and policies to meet our goals. Last year Greater Cincinnati was recognized as the most sustainable metro in the United States by Site Selection's Sustainability Rankings.

To continue this momentum, I passed a motion to update the Green Cincinnati Plan (GCP) and develop our vision for a sustainable, equitable, resilient city. As Mayor, I am committed to doing what it takes to ensure this vision reaches and positively impacts all Cincinnati communities.

I want to thank everyone who has helped prepare this plan, and I call on all Cincinnatians to help us make the Green Cincinnati Plan a reality.

Thank you,

Mayor John Cranley

THE OPPORTUNITY

With billions of people worldwide living in cities, cities have an unparalleled opportunity to make changes that can transform local economies and positively impact people's' lives. Whether it's improving building infrastructure, mobility, or food systems, city action can dramatically mitigate greenhouse gas emissions while providing a multitude of benefits like creating jobs and improving public health, conserving natural resources, and improving the quality of life.

Cincinnati is a unique city with a rich history of culture and industrialization. This legacy is part of our story and central to our city's character, but the changing economic and environmental realities have prompted our government, businesses, and communities to embrace a more sustainable path.

The Green Cincinnati Plan is the roadmap to guide this transition and build a more sustainable, equitable, resilient future for our city. The goals and recommendations included in this plan are believed to be the highest-impact, most feasible strategies for reducing the risks of climate change, growing green-sector economic opportunity, and improving comfort and quality of life for all citizens of Cincinnati. In this plan you will find ambitious goals and practical action steps to shape our collective future.

"A Native American taught me that the division between ecology and human rights was an artificial one, that the environmental and social justice movements addressed two sides of a single larger dilemma. The way we harm the earth affects all people, and how we treat one another is reflected in how we treat the earth."

- Paul Hawken
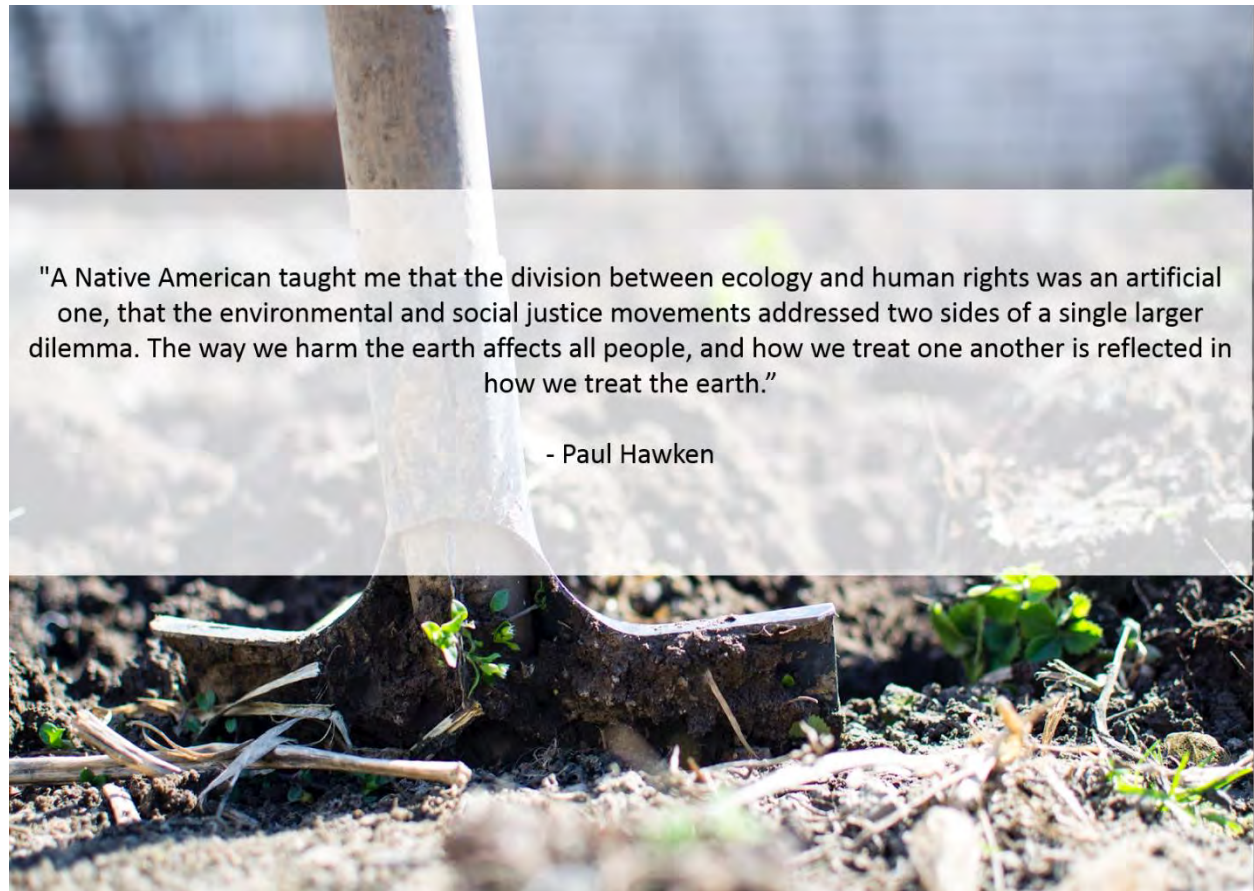
CONTRIBUTORS

STEERING COMMITTEE

Steering Committee members were appointed by the Mayor to offer guidance on process, community engagement, and content of the plan. The committee is comprised of individuals representing government, corporate, academic, non-profit, faith, and community perspectives. Membership on the Steering Committee does not imply endorsement of the plan.

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Nathan Alley
Sierra Club

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Cincinnati Metropolitan
Housing Authority

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PROCESS

Building on a decade of success, the 2018 Green Cincinnati Plan has been a community-wide, community-driven collaborative effort. Guided by a diverse Steering Committee composed of local business, faith, nonprofit and government leaders, the 2018 Green Cincinnati Plan is built on three central pillars: Sustainability, Equity and Resilience.

Timeline

July 2017:	Mayor Cranley and City Council pass motion to update the Green Cincinnati Plan
August 2017	Mayor appoints 30 Local leaders to the Green Cincinnati Plan Steering Committee
September 2017 - March 2018:	Four meetings of the Steering Committee
September 2017:	Green Cincinnati Plan Kickoff at the Cincinnati Zoo; first meeting for 8 task teams; generation of plan recommendations
November 2017:	Second meeting of 8 Task Teams to refine recommendations
November 2017 - March 2018:	University analysis of carbon reduction potential, and cost-benefit for proposed recommendations
February 2018	Third meeting of 8 Task Teams, approve recommendations
February - March 2018:	Community outreach meetings and Public Comment Period
March - April 2018:	Identification of recommendation champions
April 2018:	Approval of Plan by Steering Committee; Presentation of 2018 Green Cincinnati Plan to City Council

Eight key focus areas were identified:

Built Environment	**Natural Systems**
Education & Outreach	**Resilience**
Energy	**Transportation**
Food	**Waste**

A Task Teams was convened for each of the focus areas. The public was invited to serve on these task teams, and hundreds of individuals responded and participated. The directive was to engage and include the community at every step in the plan formation. To meet that challenge each team held three public input meetings. Hundreds of residents participated in the 30+ public meetings and contributed over 1,400 recommendations for sustainable action. The effort was supported by the University of Cincinnati and Xavier University who assisted with analyses of economic and greenhouse gas reduction potential for each recommendation.

Three additional meetings were hosted for Spanish speaking residents to ensure that language would not be a barrier to participation. Community-specific meetings were held in Avondale (Gabriel's Place) and South Cumminsville (Working in Neighborhoods) to ensure that a diverse range of perspectives were heard.

The 2018 Green Cincinnati Plans outlines 80 high-impact recommendations to reduce our carbon emissions 80% by 2050. The plan identifies 26 measurable goals that will be used to measure our progress toward a sustainable, equitable, and resilient Cincinnati.

A Note from the Green Cincinnati Plan - Spanish Language Team:

As the City updates the Green Cincinnati Plan, it is important that we are capturing all of the voices in our community. The Hispanic Team is helping do this by making sure that the voices of the immigrant community are a part of shaping this plan. The Spanish Language Team has held listening sessions, in Spanish, at Holy Family Church in Price Hill and the largest Hispanic church in the community, San Carlos Borromeo (Bond Hill), with over 70 people attending. We recognize that language barriers might affect access to services and sustainability initiatives. So, we discussed improving bus routes to Hispanic communities, creating a Spanish language emergency phone/texting tree to alert people in the event of a disaster or emergency, and business development support for immigrant-run green businesses. Other suggestions included tapping into the existing skills and strengths of the Hispanic community such as cultivating local food and construction skills that can be transferred to activities like installing solar panels. We will continue to convene with religious and non-profit organizations for our listening campaign by holding community meetings throughout Cincinnati as the Plan progresses. Our next step will be to create working groups that focus on our top suggestions adopted by the City. By intentionally including all of the voices in our community, we know that Cincinnati will be able to develop a Plan that will help create the most sustainable, equitable and resilient community possible.

Flequer Vera
Spanish Community Liaison
Sustainergy

CLIMATE CHANGE IN CINCINNATI

Climate change is a global concern, with unique local implications. While many are familiar with the issues of melting ice caps, rising sea levels, forest fires, and hurricanes seen in the news, those aren't the impacts we expect to experience in Cincinnati.

HEAT

Cincinnati is heating up and will continue to do so. By the end of the century the average annual temperature in Cincinnati is expected to rise seven degrees and include two major heat waves per year.[1] Our summers will start to feel more like Pharr, TX, a border city 1,400 miles south of Cincinnati![2] Right now, Ohio averages five days per year that are considered dangerously hot (Over 95°F). That's two more sweltering days than we saw in 1950, but by 2050 we can expect over 30 dangerously hot days per year. More dangerous heat days mean higher rates of asthma, heat rash and cramps, as well as heat stroke, which can be fatal. Increased heat will affect more than your summer plans. Hotter weather means higher evaporation rates. Rivers like the Great Miami could shrink by 35%[3], and agricultural productivity will suffer. Winters will be warmer too. With changes to the freeze/thaw cycle comes some unexpected challenges like flooding, increased insect and weed populations, and loss of native species that require cold weather.[4]

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[1] (National Centers for Environmental Information, 2016)
[2] (World Climate Research Programme, 2016)
[3] (U.S. Army Corps of Engineers, 2017)
[4] (Union of Concerned Scientists, 2012)

STORMS

Photo courtesy of Cincinnati Park Board

The Queen City has seen almost a 40% increase in the amount of precipitation falling in very heavy rain events since the 1950s, and it is predicted that this trend could cause the Ohio River to surge by 25% in the next 30 years.[5] Major storm events can cause major damage, ranging from sewer backups, to landslides, to flash flooding. The storms of 2017 have forced the City to spend over $50 million on storm-related issues. These costs have prompted the City to form an Extreme Weather Task Force to evaluate policy recommendations to prepare for and minimize future storm damages.[6]

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[5] (National Centers for Environmental Information, 2016)
[6] (U.S. Army Corps of Engineers, 2017)

PESTS

As the climate changes and temperatures rise, winters will become shorter and Ohio growing seasons could extend by 6 weeks. While potentially good for farmers and food production, it also impacts insects and agricultural pests. As CO_2 levels increase, the nitrogen levels of plants fall—a crucial nutrient for most insects.[7] This can cause pest attacks to be more severe as they eat more plants to gain more nitrogen. And with shorter winters, more of these agricultural nuisances will live longer. Extended periods of hotter weather could mean more ticks and mosquitos in Ohio, and therefore more global spread of infectious diseases and local spread of vector-borne diseases like Lyme.[8] Some fungi and other pathogens are moving northward up to 4 miles per year. As Cincinnati heats up, not only will we have to prepare for bigger populations of familiar pests, we will need to keep an eye out for some we've never encountered before.

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[7] (Bebber, 2013)
[8] (Ostfeld, 2015)

HEALTH IMPLICATIONS

As Cincinnati's climate changes, there could be many changes that affect our daily health. Air quality deteriorates as hotter weather causes more pollutants—ozone and fine particles—which exacerbates respiratory conditions like asthma and chronic obtrusive pulmonary disease.[9] As air pollution increases, so do negative cardiovascular outcomes like heart attacks and deep vein clots. As extreme temperatures become the new normal, Cincinnati could see heat-related deaths increase by 70-120% by the 2080's.[10] Additionally, the rise of heavy downpours and floods due to climate change will lead to more sewer overflows and wet basements. These events can cause mold to grow in homes and businesses, and transport disease-causing bacteria, viruses, and parasites.[11]

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[9] (Great Lakes Adaptation Assessment for Cities, 2013)
[10] (Natural Resources Defense Council, 2014)
[11] (World Health Organization, 2013)

AGRICULTURAL DISRUPTIONS

One of the chronic threats to agriculture from climate change in the Greater Cincinnati Area is crop loss. Rise in average temperatures will lead to longer frost-free seasons and other conditions that can increase crop yield (such as higher concentrations of atmospheric CO2), but this heat will also lead to severe drought and pest issues. Across the state of Ohio, summer drought severity is projected to increase by 50% by 2050.[12] Lower, more erratic water levels and rising temperatures will cause inland Greater Cincinnati counties such as Butler and Warren to experience the worst droughts in the area.[13] Hotter summers will create more high-risk working conditions for farmers, and cause crop ranges to migrate north (particularly for corn and soy, resulting in major economic output losses). Wetter springs, more flooding, and effects to quality of agricultural water resources will create more production unpredictability and lead to crop losses if farms are not prepared for severe events.[14]

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[12] (U.S. EPA, 2016)
[13] (U.S. Army Corps of Engineers, 2017)
[14] (Xavier University, 2007)

IN-MIGRATION

We've already seen some of the effects of climate change in Cincinnati—hotter summers, warmer

winters, more frequent large flood events—but other parts of the world are being affected more rapidly. Across the globe, the risk of people being displaced due to natural disasters is 60% higher than it was 40 years ago. This has equaled an average of 21.7 million people per year being displaced over the last decade.[15] This is an equity issue since those first and most severely affected are less economically stable populations, such as developing countries and low-income communities in developed nations. In 2017 alone in the U.S., the wildfires out West and Hurricanes Harvey and Irma have left several dozen casualties, hundreds of people missing, and thousands of homes destroyed.[16] When all climate risks are considered, Ohio is the third safest state in the country and well situated to become a climate haven.[17] Being one of the largest cities in the state, Cincinnati is preparing its infrastructure and economy to be resilient to climate change. We should prepare to receive those who might relocate to our community.

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[15] (Missirian, 2017)
[16] (Feng, 2010)
[17] (Moody's Investor Service, 2017)

MEGA TRENDS

As we look to the future, there are some major changes ahead - new technologies and cultural shifts that have the potential to reshape our world. Cincinnati's sustainability and resilience plans will not be effective if they don't anticipate these major shifts in how we will live.

VEHICLE ELECTRIFICATION

If you drive, chances are you are seeing more electric vehicles (EVs) on the road. And seeing as U.S. EV sales increased by over 20% last year and 127 electric models will be introduced over the next 5 years, we'll be seeing a lot more.[18] This is great news for the climate. About 30% of national greenhouse gas emissions come from transportation (not to mention it's the single largest source of local air pollution!). EVs are a promising solution for climate friendly transport, particularly since American power generation has become significantly less carbon intensive over the last decade. Additionally, EV maintenance is cheaper than gasoline vehicles, the price of electricity is more stable than gas, and EV owners already save almost $800 per year in fuel costs.[19] The tipping point is close—the purchase price of EVs is expected to be the same as gas cars by 2022.[20] We are getting ahead of the curve here in Cincinnati by supporting the charging infrastructure needed for this shift.

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[18] (Roper, 2017)
[19] (Union of Concerned Scientists, 2017)
[20] (Boston Consulting Group, 2017)

AUTONOMOUS VEHICLES

Autonomous vehicles (AVs) are cars that can sense their surroundings and traffic patterns, and navigate without human input. By making driving routes more efficient and reducing the frequency of crashes, AVs could help lower congestion, particularly once enough of them are on the road. By reducing the effect of human error, they have the potential to create more reliable, safer, and more equitable transportation systems.[21] Cities across the world, including Cincinnati, are considering this shift as more research is done on how AVs will affect driving patterns, safety, and congestion. With vehicle electrifications and policy in place that promotes community needs like public transit, AVs have the potential to reduce energy consumption in the transportation sector by up to 90% and cut costs of

vehicles and infrastructure by 40%.[22] Furthermore, current transit systems often fail to serve all communities equally. AVs could be deployed in cities to improve access for individuals disadvantaged by disability, income, and more.[23]

One of the most profound effects of AVs may be the elimination of parking. In cities, driverless ride share vehicles are expected to displace many single-owner vehicles. AVs will go directly from one passenger to the next, rarely parking, giving cities the opportunity to repurpose space currently devoted to parking lanes and parking structures.

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[21] (UC Davis, 2017)
[22] (NREL, 2013)
[23] (Union of Concerned Scientists, 2017)

RENEWABLE ENERGY

Where our energy comes from makes a difference. Last year the U.S. power sector's greenhouse gas emissions fell more than 4% to the lowest levels since 1990 and average national retail electricity prices have declined almost 6%. In 2017, 18% of U.S. electricity came from renewable resources like solar, wind, and hydroelectric dams.[24] Not only is this good for emissions and costs in the long term, this sustainable transition mitigates unpredictable economic and public health risks associated with fossil fuels. Currently, 9% of Ohio's energy comes from renewables.[25] Having committed the City government to 100% renewable energy by 2035, building the largest municipal solar array, and being home to the 1st program in the country to offer 100% carbon free energy for gas and electricity, Cincinnati is leading the way.

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[24] (Business Council for Sustainable Energy, 2018)
[25] (U.S. DOE, 2018)

GREEN JOBS

As the climate changes, economies across the world are transitioning towards sustainability-focused workforces. But you might be wondering, what exactly is a "green job?" It's pretty simple—it's any job that produces goods, services, or processes and improves environmental and social impacts. Renewable energy is creating jobs 12 times faster than the rest of the U.S. economy. There were more than 4 million green jobs as of 2017. Average wages for these jobs are almost $5,000 more than the national median and many of them are on-site, which means they cannot be outsourced.[26] As demand for sustainable goods and services rapidly grows, "green" jobs increasingly come in all shapes and sizes: renewable energy, energy efficiency, transportation, public sector, corporate sustainability, and more. And we're lucky to be in Cincinnati on this front—Cincinnati ranked second in the country in 2017 for Best Cities for a Green Career![27]

[26] (Environmental Defense Fund, 2017)
[27] (Thompson, 2017)

SUSTAINABILITY MILESTONES

2006

- The City of Cincinnati Office of Environmental Quality is formed.

2007

- LEED Tax Abatement introduced to encourage high-performance buildings

2008

- Cincinnati adopted the 2008 Green Cincinnati Plan as a roadmap for how Cincinnati can be a national leader in addressing global climate change and make Cincinnati a healthier place to live.

2009

- Free Parking for electric vehicles at all City parking meters, and some City garages.
- Phase 1 of Energy Efficiency Retrofits in City Buildings. In 3 phases, the City completed deep retrofits on more than 60 buildings, reducing the City's energy bills by more than $2 million per year.

2010

- Enhanced curbside recycling offering new, larger recycling carts.

2011

- Green Umbrella restructured as a regional sustainability alliance, becoming a backbone organization for sustainability efforts in the region.
- Zoo installs 1.5 mW solar canopy over parking lot.

2012

- 100% Renewable Electricity – The City of Cincinnati completed the "electricity aggregation" process in 2012, buying electricity in bulk on behalf of approximately 60,000 residential and small commercial accounts.
- Car Sharing – Zipcar became Cincinnati's first car sharing company, with vehicles located in Downtown and Over-The-Rhine.
- Cincinnati adopted a new comprehensive plan, called *Plan Cincinnati*, and one of the five primary initiatives at the core of the plan is to "Sustain – Steward resources and ensure long-term viability."
- Solar Power Purchase Agreement - Installed solar panels on 3 City facilities: College Hill Rec Center, Beekman Garage, and One-Stop Permit Center.

2013

- 2013 Green Cincinnati Plan published

2014

- Red Bike bikeshare launched in Downtown and Uptown neighborhoods

2015

- Cincinnati District 3 police station- Built as a sustainable, energy efficient and environmentally-friendly facility meeting LEED Platinum status, the new station is designed to generate as much energy as it consumes.
- Expansion of the Red Bike system, which increased the size from 35 stations to 50 stations.
- First Annual Midwest Regional Sustainability Summit- attended by more than 300 individuals representing 150 businesses and organizations.

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- Electric Vehicle Chargers- OES brokered resources from Nissan and Clean Fuels Ohio to obtain electric vehicle DC fast chargers at 5 locations in Cincinnati.
- Natural Gas Aggregation- the City entered a new Natural Gas Aggregation Contract with Constellation Natural Gas as the provider. Approximately 46,000 of 69,000 eligible households were purchasing their natural gas through this program.

2016

- Opening of Cincinnati Bell Connector- The streetcar operates on a 3.6-mile loop
- Solarize Program launches, accelerating the pace of residential solar installations.

2017

- Curbside textile recycling- Residents are now able to recycle clothing, textiles and housewares just as easy as they can recycle other items.
- Cincinnati signs a contract to provide 100% green energy to City facilities.
- Cincinnati becomes the 1st aggregation program in the US to offer 100% green energy for both electricity and natural gas.
- Mayor Cranley signs the Compact of Mayors- a global agreement of 648 cities that have agreed to measure emissions and climate risk and publicly report findings.
- Mayor Cranley commits Cincinnati to 100% Renewable energy by 2035

Draft 2018 Green Cincinnati Plan

MEASURING OUR PROGRESS: GREENHOUSE GAS EMISSIONS

The City of Cincinnati recognizes that climate plays an important role in the quality of life, economic well-being, and long-term sustainability of our City and region. Greenhouse gases (GHG) like Carbon Dioxide (CO_2), Methane (CH_4), and Nitrous Oxide (N_2O) as the result of human activity are collecting in the Earth's atmosphere at levels that are altering our climate. The Green Cincinnati Plan outlines steps we can take to mitigate our region's environmental impact. Cincinnati conducts greenhouse gas inventories to measure this impact, and gauge the success of our sustainability efforts. Cincinnati's first GHG inventory was conducted in 2006, and serves as the baseline from which our climate impact is measured. The following summary of Cincinnati's 2015 Greenhouse Gas Emissions and Analysis shows that our efforts, combined with changes in the region's energy supply, have been effective in reducing our emissions. With this information the City of Cincinnati can measure our progress on our path to sustainability and provides data to inform policy and decision making.

CHANGES IN CINCINNATI GREENHOUSE GAS EMISSIONS BY SECTOR FROM 2006 TO 2015

2006	2015	Change
9.3 million tons CO_2e — City of Cincinnati Community GHG emissions	7.6 million tons CO_2e — City of Cincinnati Community GHG emissions	↓ -18.4%
432,000 tons of CO_2e — Cincinnati City Government GHG emissions	275,736 tons of CO_2e — Cincinnati City Government GHG emissions	↓ -36.3%
28.2 tons CO_2e per person — Population: ~330,000	25.3 tons CO_2e per person — Population: ~300,000	↓ -10.3%

CINCINNATI'S PLAN OF ACTION

- Short Term Target: reduce GHG emissions 8% below 2006 levels by 2012 - ACHIEVED
- Medium Term Target: reduce GHG emissions 40% below 2006 levels by 2028
- Long Term Target: reduce GHG emissions by 84% below 2006 levels by 2050

Greenhouse Gas Emissions Reduction Goal
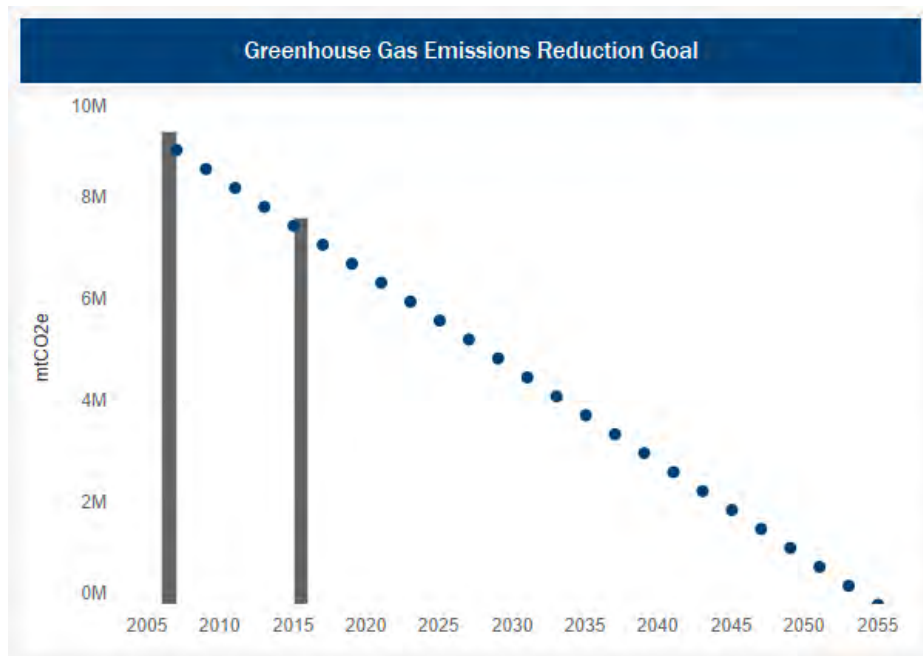
2015 GOVERNMENT EMISSIONS

The 2015 Government emissions inventory includes emissions generated from municipal operations, including energy used in water and wastewater treatment, city building and facilities operations, streetlights, traffic signals, vehicle fleet and aviation fuel use. Together, these operations generated approximately 275,736 mtCO2e (metric tons carbon dioxide equivalent), representing a 36.3% reduction from 432,617 mtCO2e reported in 2006.

This reduction can be attributed to many factors, including but not limited to:

1. Street light conversion to LEDs
2. Facility energy improvement upgrades/retrofits
3. Upgrades to Metropolitan Sewer District's incinerators
4. Installation of solar panels on some City owned facilities.

2015 Municipal Emissions by Sector

Aviation Fuel 8.27%
Buildings and Facilities 13.42%
Streetlights and Traffic Signals 7.00%
Vehicle Fleet 6.47%
Water & Wastewater Treatment Facilities 64.84%
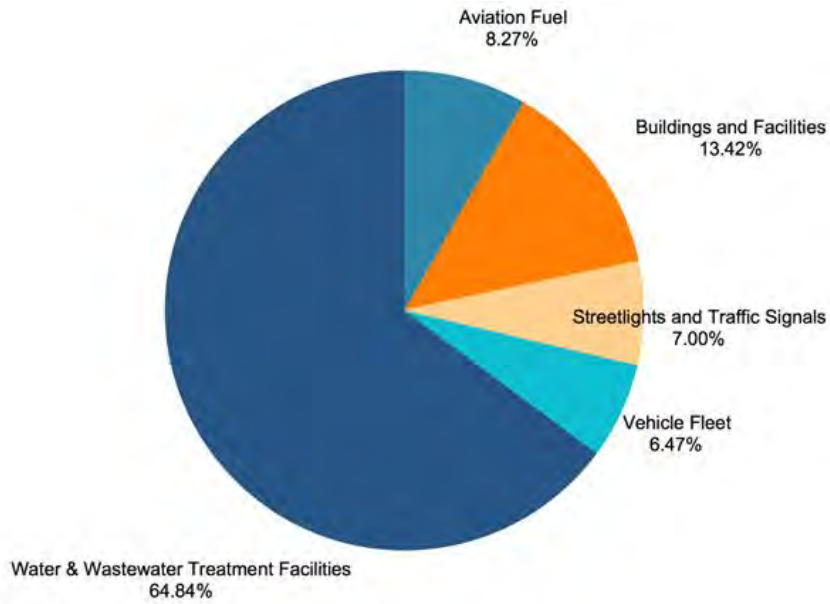
Changes in Cincinnati's Greenhouse Gas Emissions from Municipal Operations from 2006 and 2015
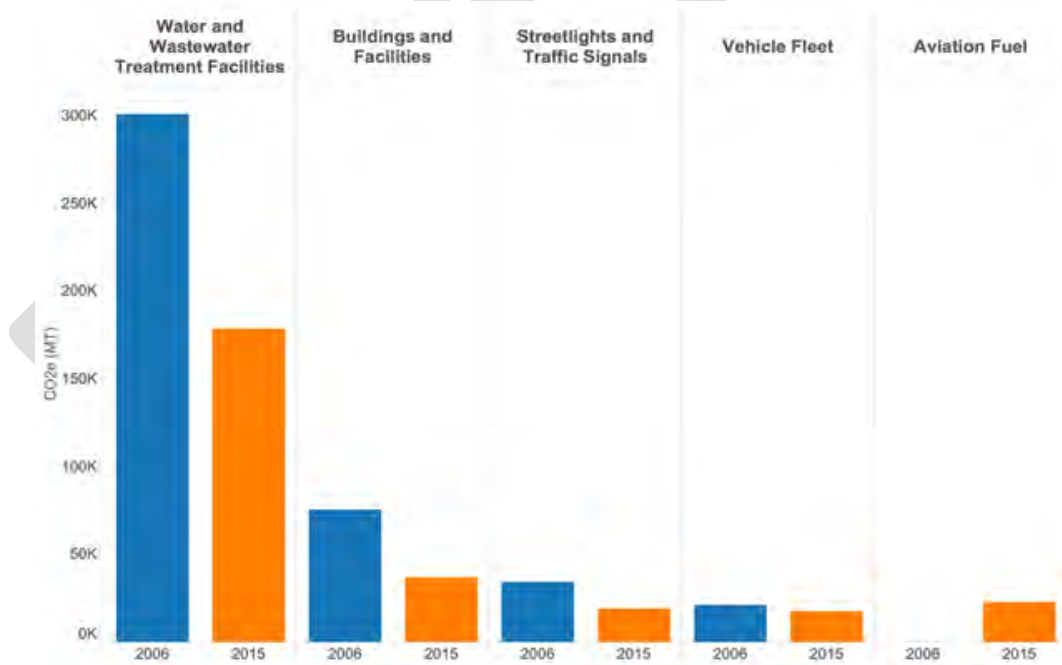
Cincinnati Government Emissions

Sector	2006 mtCO2e	2015 mtCO2e	2006-2015 Change
Water & Wastewater Treatment Facilities	301,265	178,742	-40.67%
Buildings & Facilities	75,649	36,986	-51.11%
Aviation (Lunken Airport)**	Not measured	22,808	NA
Street Lights & Traffic Signals	34,250	19,292	-43.67%
Vehicle Fleet	21,453	17,908	-16.52%
Total	432,617	275,736	-36.26%

**Aviation fuel sold at Lunken Airport was not included in the 2006 analysis.

2015 COMMUNITY EMISSIONS

The Community emissions inventory includes emissions generated from commercial, industrial, and residential gas and electric consumption, motor vehicle transportation, and solid waste generation. Together, these sectors generated approximately 7.3M mtCO2e in 2015, representing a 17.4% reduction from 8.9M mtCO2e reported in 2006.

2015 Community Emissions by Sector
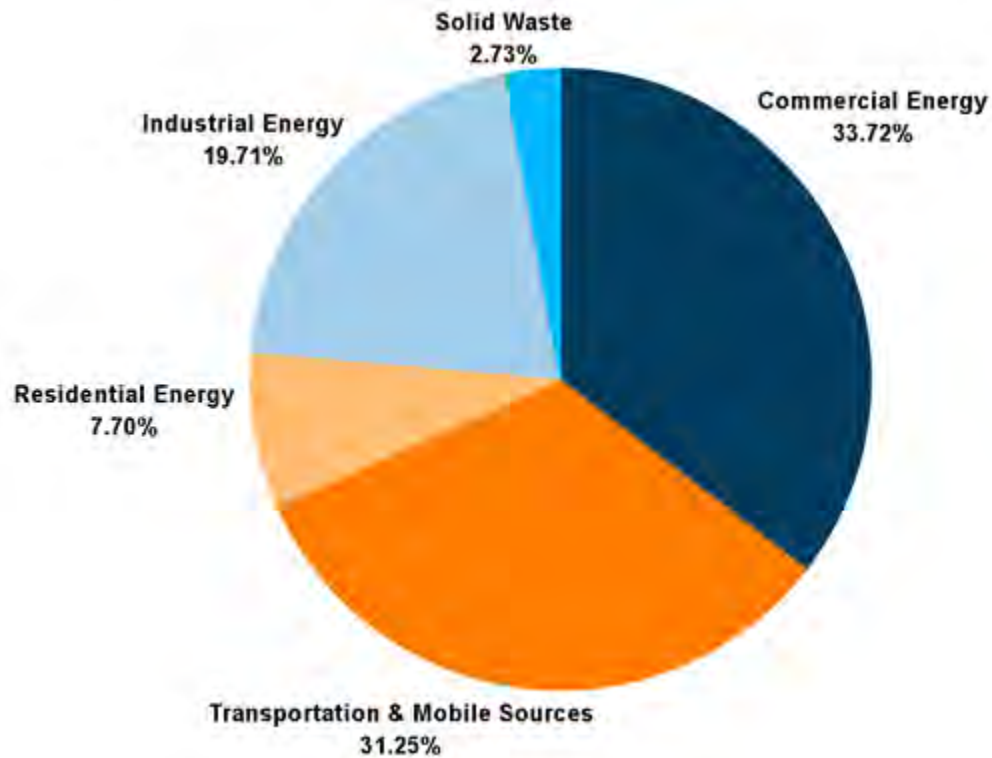
This reduction can be attributed to many factors, including but not limited to:

1.   Incentives for residential and commercial energy efficiency upgrades offered by Duke
2.   Grid decarbonization
3.   100% Renewable energy offered to residents and businesses through the City's Energy Aggregation Program
4.   Population loss from 2006 to 2015 (approximately 10%)
5.   Improved waste diversion

Cincinnati Community Greenhouse Gas Emission Changes from 2006-2015
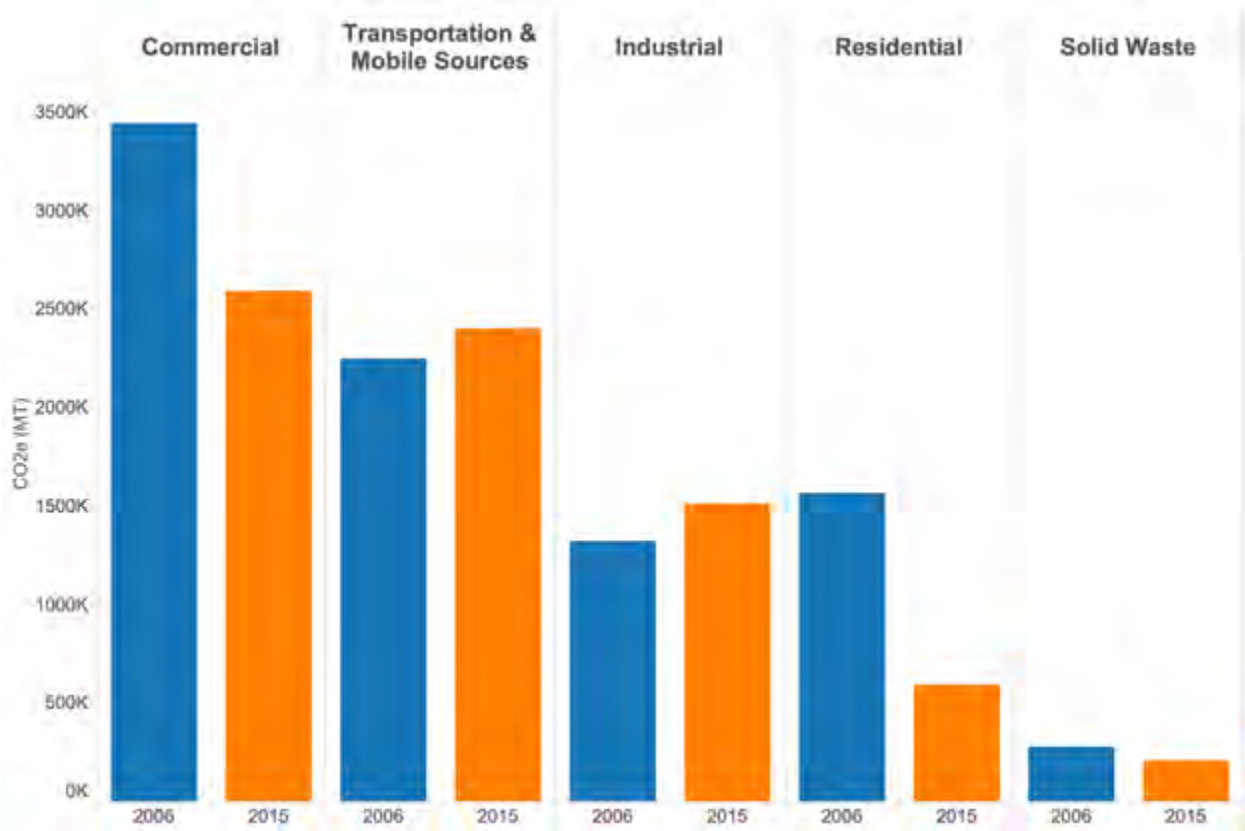
Cincinnati Community Emissions

Sector	2006 mtCO2e	2015 mtCO2e	2006-2015 Change
Commercial Energy	3,449,657	2,594,101	-24.80%
Transportation & Mobile Sources	2,251,539	2,404,500	6.79%
Industrial Energy	1,324,833	1,516,458	14.46%
Residential Energy	1,571,401	592,648	-62.29%
Solid Waste**	282,458	210,348	-25.53%
Total	**8,879,888**	**7,318,055**	**-17.59%**

**Solid Waste totals were estimated based on Hamilton County waste totals.

2015 CITYWIDE EMISSIONS

Taken together, Government and Community emissions total approximately 7.6M tons CO2e, representing a citywide reduction of 18.4% since the 2006 baseline was established at 9.3M tons CO2e. Analysis shows that Community emissions comprise 96.4% of Cincinnati's emissions, while Government emissions account for 3.6%. The largest increases in emissions occurred in the industrial energy and vehicular travel sector, while the largest reductions were seen in the commercial and residential energy sectors.

Cincinnati Greenhouse Gas Emissions by Sector

2015 Greenhouse Gas Sources

Vehicle Fleet 0.24%

Aviation (Lunken Airport) 0.30%

Water & Wastewater Treatment Facilities 2.35%

Buildings & Facilities 0.49%

Transportation & Mobile Sources 31.66%

Commercial Energy 34.16%

Street Lights & Traffic Signals 0.25%

Solid Waste** 2.77%

Residential Energy 7.80%

Industrial Energy 19.97%
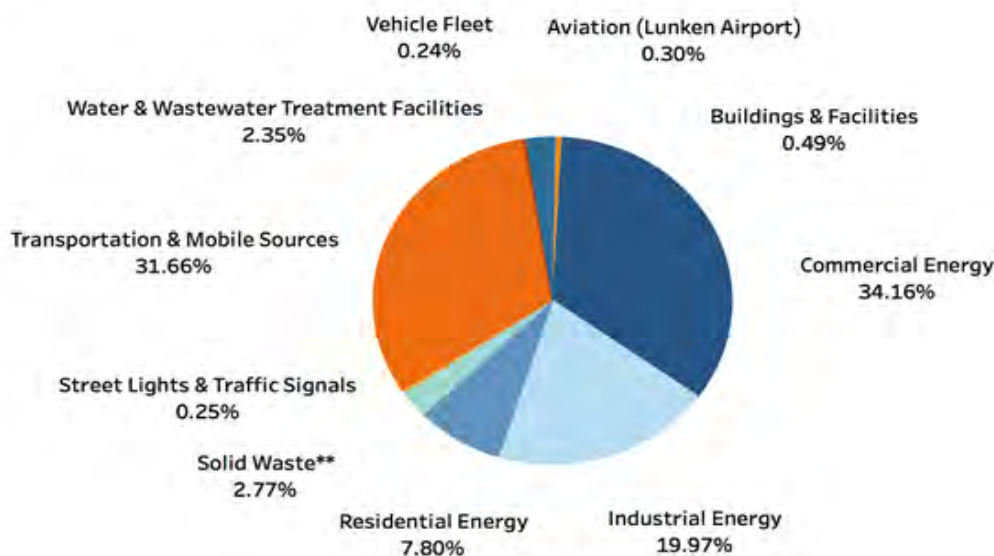
SIGNIFICANT CONTRIBUTING FACTORS

Grid Decarbonization

From 2006 to 2015, the energy grid that powers the Cincinnati region has changed in ways that have reduced the greenhouse gas emissions generated by the power we use. While coal accounted for the generation of 86% of our regional energy in 2006, that percentage dropped to 59% in 2015. This shift is largely explained by the surge in natural gas usage, which accounted for 23% of energy in 2015, compared to 2% in 2006. Together, these shifts have resulted in a 10.3% reduction in GHG emissions associated with our City's grid energy use.

Population Changes

The population of City of Cincinnati declined from 332,185 in 2006 to 298,550 in 2015.   The direct impact of this change on our emissions profile is difficult to measure, but certainly contributes to the reduction we have seen since 2006.

100% Green Energy through Utility Aggregation

Enabled by energy deregulation, the City of Cincinnati's electric aggregation program is able to provide 100% renewable energy to participating residents and businesses. Through this program, the City purchases 405 mWh of electricity, effectively eliminating over 250,000 mtCO2e from the atmosphere.

City Facility Energy Performance Improvements

Since 2006 the City of Cincinnati has made significant investment in energy improvements for City facilities in the form of LED lighting upgrades, HVAC enhancements, and pump and incinerator improvements. These improvements have collectively reduced the emissions associated with facility operations by 51%.

Commercial Energy Consumption

Commercial energy consumption saw a 24.8% reduction from 2006 to 2015. This reduction is explained by the commercial energy efficiency incentives offered by Duke Energy in the region.

Waste Reduction and Landfill Diversion

Cincinnati was an early adopter of radio frequency identification (RFID) tag technology in our waste and recycling carts. The technology allows the city to better track participation in waste and recycling programs. The data collected has been used to improve our recycling outreach efforts, helping to drive a 25.3% reduction in solid waste related emissions.

What's not counted

There are many behaviors that contribute to GHG emissions, but that are not accurately captured by this type of analysis. Our consumption is under-measured. The food we eat and the goods we buy generate GHG emissions that are not easy to measure as part of Cincinnati's carbon footprint because the production of those items often takes place outside of the city. Nonetheless, the consumer choices we make significantly our carbon output, and we should be mindful of the impact of our behaviors.

CITIZEN SURVEY RESULTS

Throughout the 2018 GCP Update process, the Office of Environment and Sustainability surveyed local residents for their thoughts on climate change impacts and action. Nearly 300 residents responded, representing more than 40 neighborhoods in the Greater Cincinnati Area. Overall 88% of Cincinnatians think climate change is already affecting our city, and 75% think it will affect their local community in some capacity.

When do you think climate change will start to affect Cincinnati?
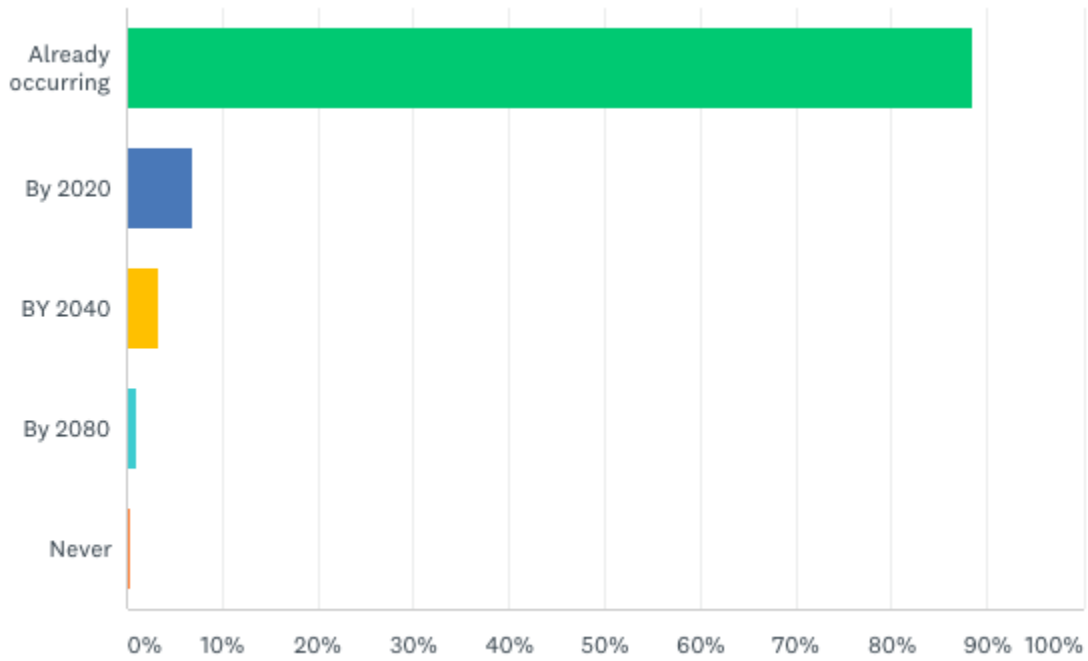
Do you think climate change will affect your community?
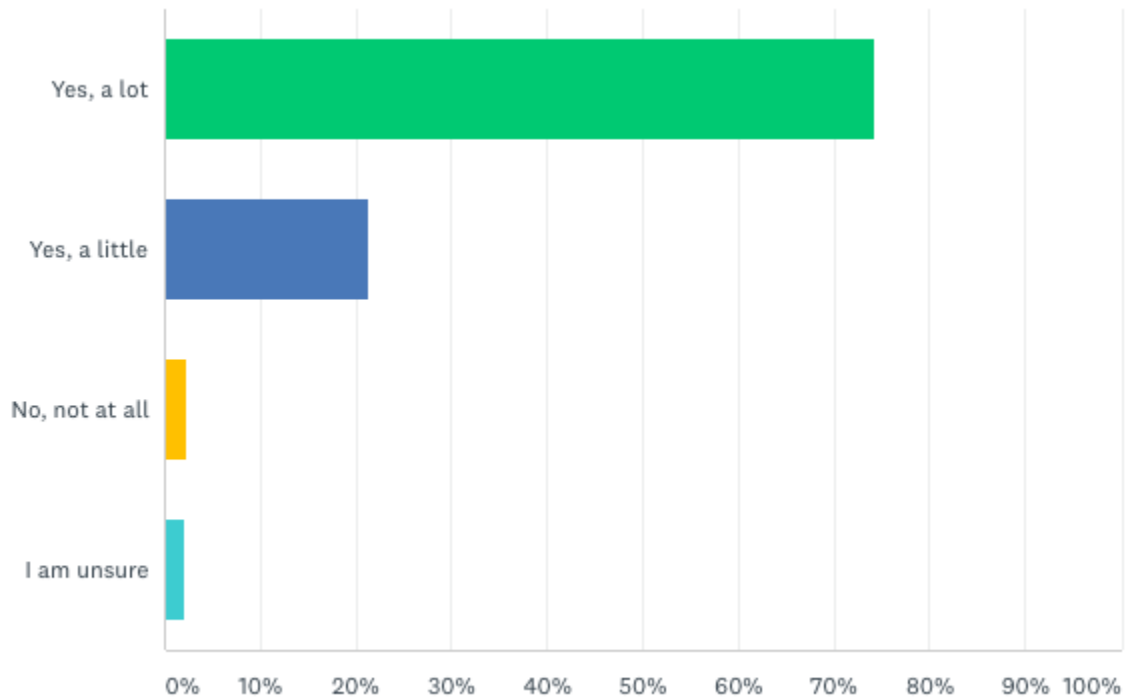
Rate your view on the impact of climate change on the following elements within Cincinnati.
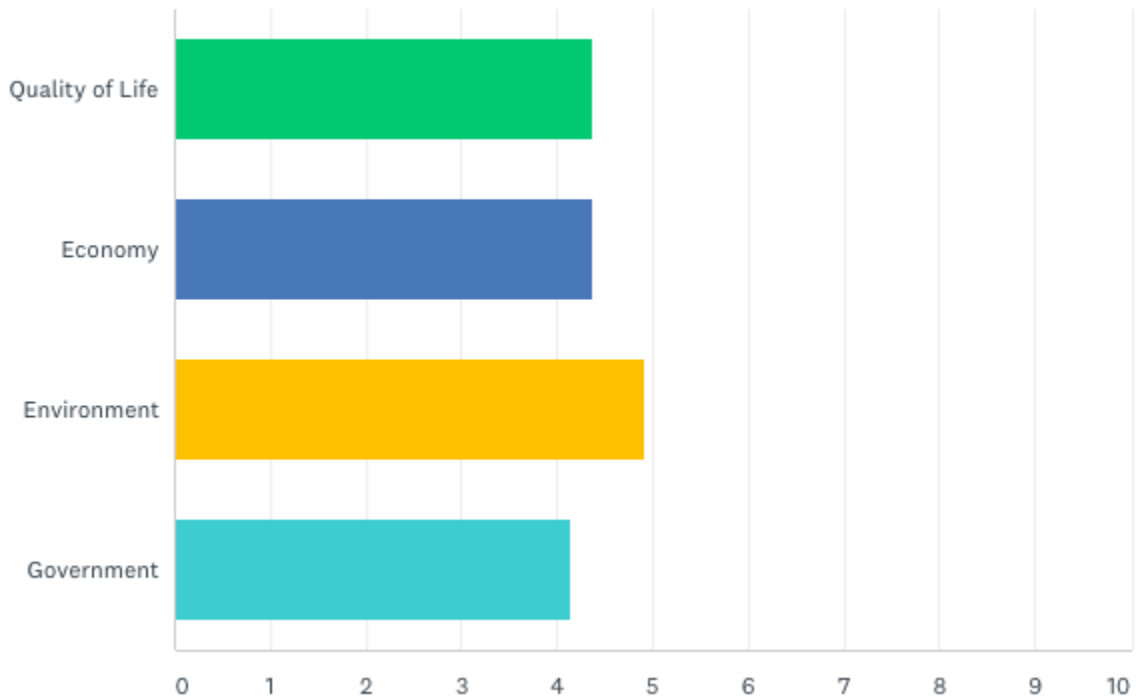
How well do you think our region's infrastructure is prepared to handle stresses associated with climate change?
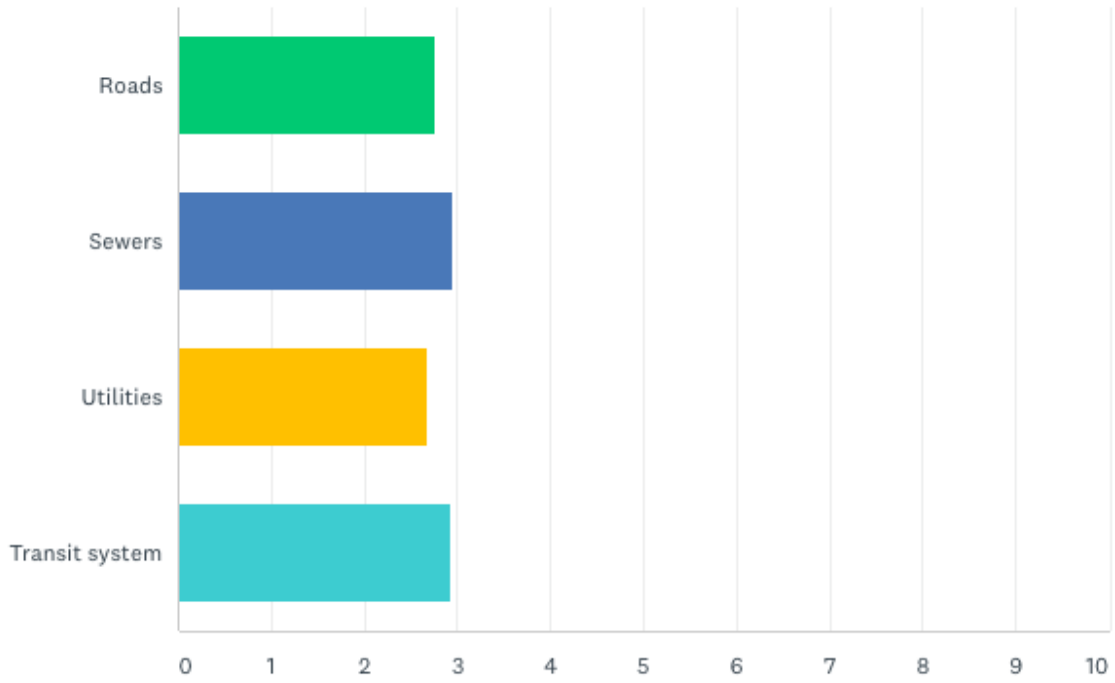
IMPLEMENTATION

The Green Cincinnati Plan includes a commitment to implementation. To ensure that we implement and reach Cincinnati's goals, the City is taking a three-pronged approach.

First, the City will continue to lead by example by greening government operations and looking for efficiency gains that save the City money.

Second, Cincinnati is full of businesses, nonprofits, and other institutions that play a key role in moving Cincinnati toward sustainability. Many times, these entities can help accomplish sustainability measures that are not well suited for City implementation. The City will partner with these entities and promote their initiatives. Each recommendation in the Plan identifies one or more "Champions" who will lead the implementation of that recommendation. The City will monitor and support the efforts of these champions to ensure that implementation is progressing. The City has partnered with BluEarth (a Cincinnati-based strategy, branding, and design firm) to develop a communication strategy to connect to as many residents as possible.

Third, we will measure our progress. Quantitative goals have been identified for each focus area of the plan. The City will work with partner organizations to track the progress for each goal. OES will report progress regularly to City Council and the GCP Steering Committee. Council or the Steering Committee can intervene if necessary to keep the effort on track.

The Green Cincinnati Plan reflects many aspects of the award-winning *Plan Cincinnati*– particularly three of five of *Plan Cincinnati*'s initiative areas – Sustain, Connect and Compete. The Green Cincinnati Plan builds on *Plan Cincinnati* to create an implementation framework for portions of these initiatives. In addition to *Plan Cincinnati*, we will work to with communities to incorporate the strategies outlined in this document within the development of neighborhood plans.

HOW WE WILL MEASURE SUCCESS

There are a lot of different ways to measure the impact of sustainability initiatives. Mechanisms are already in place via Cincy Insights for tracking greenhouse gas emissions and we've worked with the community's input to create ways of measuring other forms of success. See the table below for the quantitative goals that will be used to track progress over the next 5 years. These metrics were selected as key indicators during the public engagement process and will be monitored on an ongoing basis. For more details on where the data are coming from, the current progress towards these goals, and more, please refer to the Recommendations chapter. All goals are intended to be completed in 5 years unless otherwise stated.

QUANTITATIVE GOALS

Built Environment	• Increase the percentage of city streets meeting complete streets requirement by 1% per year (center-lane miles) • Decrease household energy burden by 10% • Make all city facilities, fleets, and operations carbon neutral by 2035
Education & Outreach	• Register 100 businesses in a green business certification program • Establish $1M in a green Cincinnati fund to advance sustainability initiatives • Increase by 10% the number of City residents that can name at least 3 actions they are doing to be green/promote sustainability
Energy	• 100% renewable energy for city government by 2035 • Triple renewable energy generation for residents and businesses • Reduce energy consumption 2% annually
Food	• Triple acreage of urban food production • Reduce food waste by 20% by 2025 • 100% of residents have convenient access to healthy, affordable foods • Double the number of residents consuming local foods • Double the number of people eating plant based diets
Natural Systems	• Attain 100% of US EPA National Ambient Air Quality Standards • Increase city-wide tree canopy coverage to at least 40%, ensure all residential neighborhoods to 30% tree canopy coverage • Meet EPA Recreational Water Quality Criteria in 90% of Cincinnati Waterways, 90% of the time • Have a park or outdoor recreation site within a 10-minute walk of every city resident
Resilience	• No increase in storm or heat related fatalities • No increase in storm damage remediation costs • 50% decrease in childhood asthma-related hospital admissions in target

	neighborhoods. Reduce disparities between neighborhoods
Transportation	• Decrease the consumption of fossil fuels, including gas, diesel, and natural gas by 20% • Increase the passenger miles travelled via public transit by 5% • Double lane miles of bike trail
Waste	• Zero Waste by 2035 • Decrease (residential) tonnage to landfill by 20% • Increase participation in city curbside recycling programs--5% in residential and 20% in commercial

REDUCING GREENHOUSE GAS EMISSIONS

Centralized choices made by cities about long-lived infrastructure and social programs will determine the local impact of climate change. Cincinnati's inspiration for how to prioritize which steps to take first was *Drawdown,* a project led by Paul Hawken that measured and modeled the top 100 solutions for global climate change. Each solution in Drawdown was ranked by greenhouse gas impact, cost effectiveness, feasibility, and benefit to society - we did the same thing. The result is 80 recommendations that will reduce climate change, grow the economy, and improve the quality of life of residents. The recommendations have been grouped into eight themed chapters. Within each chapter, you will find these strategies ordered by their greenhouse gas reduction potential.

The goal is to reduce emissions by 34% of 2006 levels by 2023 and 84% by 2050. If this goal is achieved, by 2050 Cincinnati will have eliminated nearly 7.5 million metric tons of carbon dioxide equivalent.

CINCINNATI'S HIGHEST CARBON REDUCTION POTENTIAL RECOMMENDATIONS

Top 10 Recommendations by 2050 GHG Impact

Recommendation	mtCO2e
Adoption of autonomous vehicles	1351763
Encourge electric vehicle use and infrastructure	1202500
Industrial energy efficiency	477316
Grid decarbonization	272416
Sustainability District	270600
Programs like Solarize & PACE	210600
Plan for population density	149760
Invest in City facility energy efficiency	82496
Increase renewables for City	81500
Incentivize recycling and increase cost of trash	77733
Energy efficiency for low-income households	75000

Blue = Transportation, Red = Energy, Green = Built Environment, Purple = Waste, Orange = Grid

GOALS AND RECOMMENDATIONS

The 2018 Green Cincinnati Plan includes 80 recommendations to achieve 80% reduction in carbon emissions by 2050, and quantitative metrics to measure the City's progress. Each of the following chapters outlines measurable goals and specific recommendations to improve the economy, quality of life, and environment in Cincinnati. Some recommendations have detailed descriptions and clear next steps, while others are aspirational and exact steps for implementation will require further development.

Each recommendation includes:

- Brief description of the recommendation
- Examples of similar projects in Cincinnati or peer cities
- Feasibility assessment
- Time needed to implement
- Champion(s) to lead implementation
- The City of Cincinnati's role
- Cost-benefit estimate
- Equity considerations
- Greenhouse gas reduction estimate

Within each chapter, the recommendations are listed in order of highest estimated carbon reduction potential.

Image: Chris Hughes

BUILT ENVIRONMENT

The man-made surroundings that provide the setting for human activity

The Built Environment Team was tasked with providing goals and recommendations for a new focus area of the City's Green Cincinnati Plan. The Built Environment refers to the man-made settings and structures, such as buildings, parks, sidewalks, and roads, that support human activity within a community. When considering Cincinnati's abundance of architecturally unique structures and neighborhoods, and it's nationally ranked top 10 municipal park system, it becomes clear that the City's Built Environment is a key attribute to Cincinnati's continued re-emergence as a one-of-the-kind destination in the Midwest.

The addition of this section in the Green Cincinnati Plan recognizes the impact neighborhoods, bike paths, downtown storefronts, and other components of Cincinnati's Built Environment have on the overall sustainability, equity, and resilience of our community.

For instance, for the City to continue to be a leader in sustainability, it will be necessary to significantly improve the energy efficiency of buildings in the community, as they alone account for approximately 60% of Cincinnati's greenhouse gas emissions. Equally important is the need to tackle persistent inequities in the community. By increasing the efficiency and walkability of the City's Built Environment, Cincinnati can alleviate the disproportionate transportation and energy burden, or the percentage of income a household spends on their transportation and household energy needs, experienced by low-income residents. Furthermore, the community must strive to better design and adapt Cincinnati's Built Environment to withstand the increased precipitation, flooding, heat waves, and severe weather that will accompany a warmer, wetter, and more unstable climate.

Fortunately, great leadership from non-profits, businesses, universities and other educational institutions, City officials, and residents throughout the community has allowed for tremendous and

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sustained progress in improving the City's Built Environment. For example, the City of Cincinnati has one of the country's most progressive programs to incentivize green building, including a 15-year LEED property tax abatement. Such policies have assisted the development of nearly 1,250 LEED projects in the Cincinnati region, and led to the construction of the nation's *first* net zero energy police station. The City of Cincinnati and its partners have also continued to educate business leaders and support incentives that encourage the construction of high-density mixed-use buildings, the development of vacant lots and brownfields, and the retrofitting of structures using the best in green building practices and materials.

We are confident that the City of Cincinnati, business leaders, and residents collectively have the ambition and expertise necessary to elevate the Built Environment of our historic community, while addressing both climate change and social inequities. Together, we shall become a beacon of success for other municipalities, not only across the Midwest, but across the country.

Tremaine Phillips
Empower
Built Environment Team Lead

Goals

1) INCREASE THE PERCENTAGE OF CITY STREETS MEETING COMPLETE STREETS REQUIREMENTS BY 1% EACH YEAR (CENTER-LANE MILES).

- Baselines:
  - Walking facilities: 1,700 miles of sidewalks
  - Bicycling facilities: 20 out of 375 miles of streets include bike lanes (5%)

The goal of a "Complete Streets" approach is to ensure that streets are safe for all individuals, support all modes of transportation, and connect diverse economic, cultural, and environmental land uses. The Department of Transportation and Engineering (DOTE) has adopted "Complete Streets" as a guiding principle for infrastructure and recognizes that streets must support pedestrians, bicyclists, and public transportation passengers of all ages and abilities, as well as trucks and automobiles. Walking and bicycling facilities are a focus area for DOTE and "Complete Streets", for which miles of sidewalks and bike lanes are a key metric.[28]

2) DECREASE HOUSEHOLD ENERGY BURDEN BY 10%.

Cincinnati, 2011	Median Energy Burden	Highest Energy Burden Quartile	Energy Burden At Least Twice the Median
All Households	4.34%		24.32%

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[28] City of Cincinnati Department of Transportation and Engineering, 2017.

Low-income	8.45%	15.49%	48.29%
Multi-family low income	6.19%	12.95%	36.99%
African-American	6.86%	15.64%	41.70%
Latino	3.87%	7.26%	22.73%
Renting	5.96%	12.12%	35.43%

Low-income energy burden
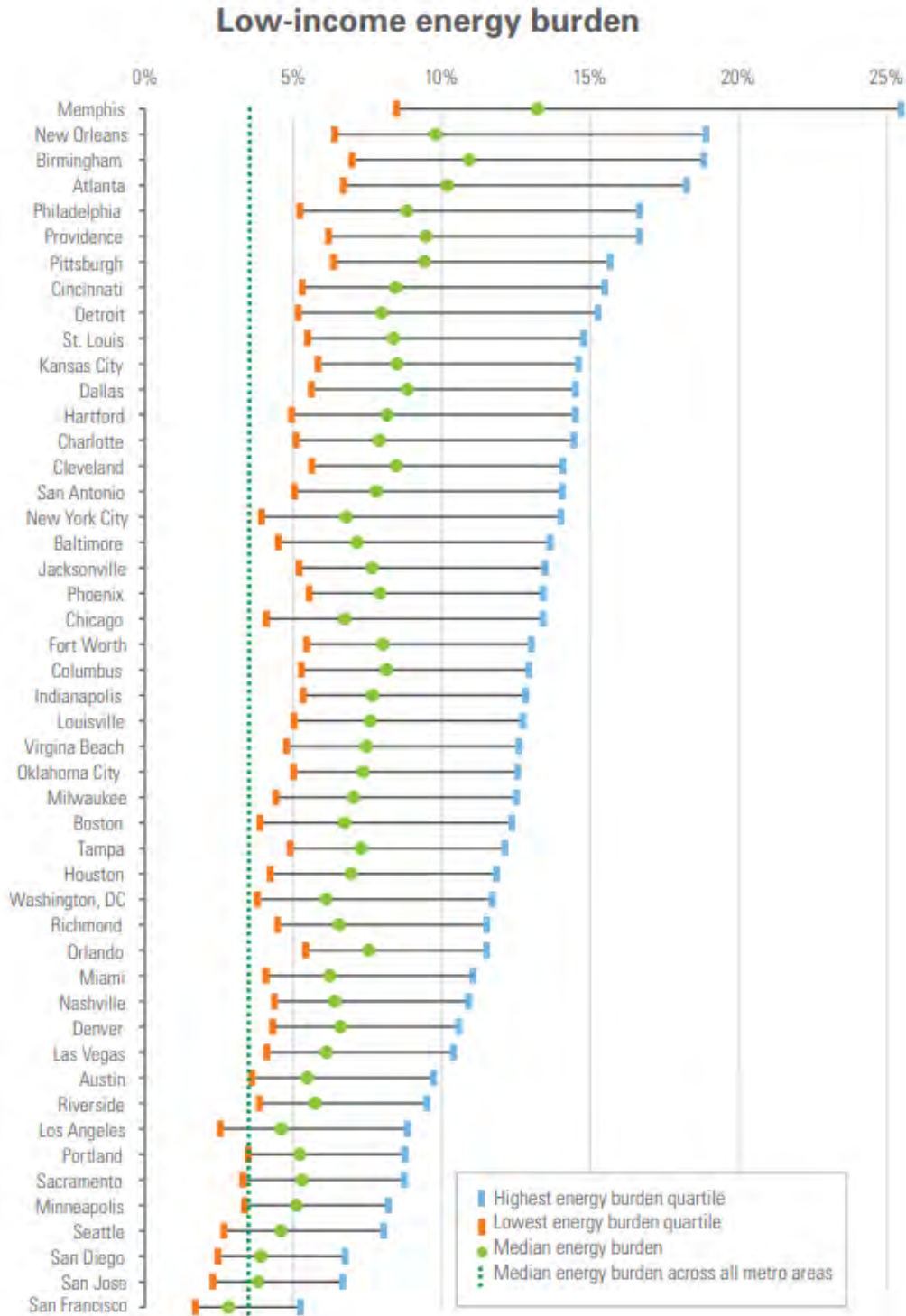
Image from (ACEEE, 2016)

Energy burden is the percentage of household income spent on home energy bills. Median energy burden was calculated by determining the energy burden for all Cincinnati households and taking the median. This analysis used data from the US Census Bureau's American Housing Survey.[29]

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[29] (ACEEE, 2016)

3) MAKE ALL CITY FACILITIES, FLEETS, AND OPERATIONS NET CARBON NEUTRAL BY 2035.
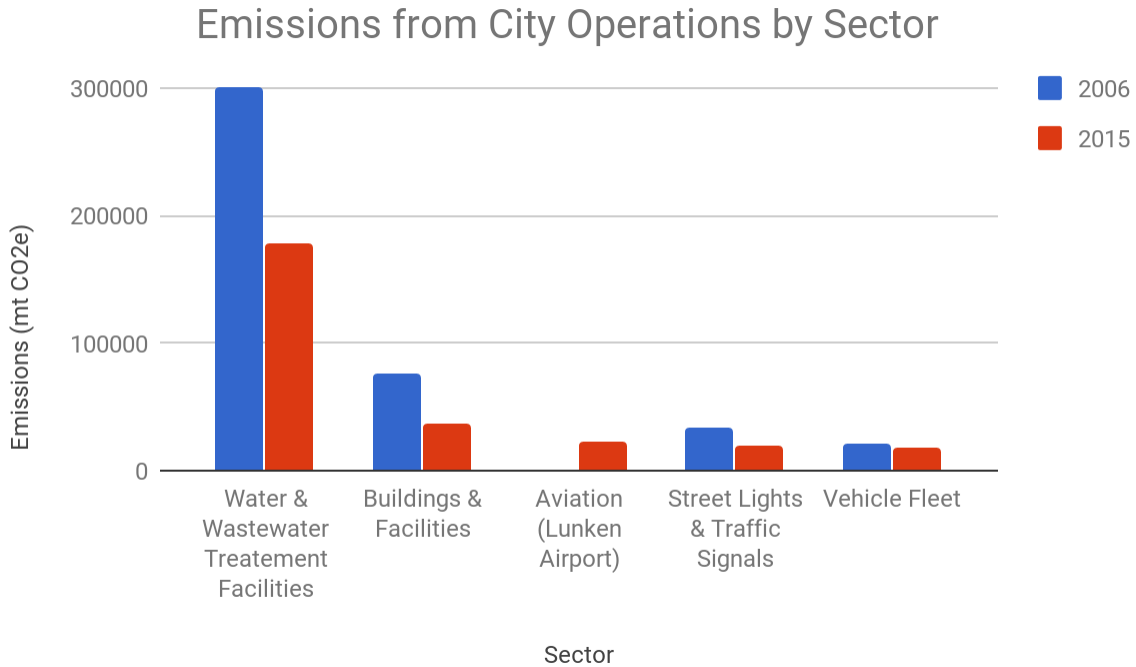
The inventory was conducted using ClearPath, an emissions management software from the International Council for Local Environmental Initiatives. It attempts to measure the emissions of greenhouse gases including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O). The activities that were assessed include transportation, industrial energy, commercial energy, residential energy, water and wastewater, and recycling and waste.[30]

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[30] (City of Cincinnati, 2015)

Recommendations

Many of the recommendations of this plan are inter-related, and have multiple benefits. For additional recommendations related to the Built Environment please refer to:

- *Natural Systems #2: Increase tree canopy and access to greenspace.*
- *Resilience #7: Encourage onsite stormwater retention and infiltration and discourage runoff by restructuring sewer and/or stormwater fee.*
- *Transportation #6: Improve neighborhood walkability, by improving sidewalk connectivity and pedestrian safety, especially in low-income neighborhoods.*
- *Transportation #10: Create a transit link between Downtown and Uptown.*

1. Create a Sustainability District (such as 2030 District).

What is it and why is it important to Cincinnati?

A sustainability district, or 2030 district, is a collection of buildings or neighborhoods that commit to three goals: reducing their building energy usage, water consumption, and transportation emissions by 50% by 2030. Sustainability districts are becoming more popular across major cities in the U.S. with peer cities such as Pittsburgh and Cleveland having active districts.

A sustainability district makes the invisible, visible and drives choices in consumption. Commitment to a 50% reduction requires the establishment of a baseline consumption level for participating buildings. This baseline establishes a "miles-per-gallon" for building performance and presents building owners with a true look at how their building performs compared to peers. Efficiency improvements can then be based on data and tracked over time. Commitment to a sustainability district often requires buy-in from leadership in the building owner's organization elevating the issue and facility decisions to senior management. This senior level commitment may often drive decisions that otherwise would not have found institutional support when competing among a variety of priorities.   Further, conservation improvements may be supported through reductions in energy and water consumption. Employee quality of life improvements through better quality of work life, improvements to indoor air quality and enhanced transportation offerings are benefits to sustainability districts as well.

To create a sustainability district, organizers must engage the commercial real estate industry here in Cincinnati. Large corporate and institutional partners who own and maintain large buildings will be key partners.   From a governmental perspective SORTA, MSD, GCWW as well as Department of Transportation and Engineering must be part of the conversation as well.

Cincinnati is working to reduce its greenhouse gas emissions by 80% by 2050. A Sustainability District naturally pairs with this goal of reducing emissions and enables public private partnerships to drive changes in consumption.

Examples of Sustainability Districts in Cincinnati and peer cities.

- Cleveland, OH 2030 District
  - Cleveland is encouraging the building of highly efficient buildings
    - The district in Cleveland stresses the importance of not only reducing the environmental impact of the building and the construction process, but also

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increase the owner's return on investment and making the business environment more competitive
- ▪ http://www.2030districts.org/cleveland
- ● Pittsburgh, PA
  - ○ Pittsburgh is creating small, highly efficient building pockets throughout the city
    - ▪ These pockets strive to reduce transportation emissions and water consumption by densifying the area and building more efficient buildings
    - ▪ http://www.2030districts.org/pittsburgh

Who will be taking the leading roles on this project?

- ● A 2030 District Exploratory Committee has been formed

Who is the target audience?
- ● Building owners and managers
- ● Cincinnati Metropolitan Housing Authority and landlord organizations to reach low income tenants
- ● Members of the public that can influence the way buildings operate

What is the City of Cincinnati's role in implementation?

The City's role will be to partner with organizations that spearhead this effort and provide assistance and support. To implement this recommendation, the City will assist in creating a campaign, along with other entities, to educate key stakeholders on how reduction of energy and water usage can help reduce environmental burdens as well as save money. The lead organizations will meet with building owners and operators to provide them with beneficial material on how efficiency will help to save money and allow their building to operate better.

Is it Feasible?
- ● Feasibility: Easy
  - ○ Several peer cities have created sustainability districts and Cincinnati has the resources to do so as well.

How much would it cost?

There will be nominal administrative costs to the City of Cincinnati for creating a 2030 district or sustainability district. Coordination between members of the agencies (see description above). One or two full time workers from each of the four agencies will likely need to coordinate to create optimal requirements. A rough estimate of seven employees contributing at average wage and benefit packages allotting 10 hours each runs around $2000 worth of labor. The private costs will be found in the efficiency upgrades that buildings implement. Costs will be incurred in reducing transportation emissions as well, whether by buying more efficient buses or encouraging ride-sharing and alternative modes of transportation. These costs are discussed more specifically in the transportation section.

Keys to Equity:
- Recruit specific buildings that house low income tenants
- Provide subsidies, tax breaks, or other forms of incentives to encourage building owners to participate
- Select a diverse cross-section of the city to include in the district
- Create diverse jobs with efficiency retrofits

Timeline for Implementation
- This recommendation will take more than 5 years to fully implement but can be started as soon as a team is created to spearhead this task. The first steps include creating a team to oversee the district, recruiting buildings, and defining goals for each building.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2030
9,020 mtCO$_2$e	90,200 mtCO$_2$e	270,600 mtCO$_2$e

The potential CO$_2$ emissions savings of the 2030 District are based on the experience of the Pittsburgh 2030 District, which witnessed energy consumption for buildings reduced by 10.7%, water use was reduced by 7.3%, and transportation emissions reduced by 24.2% in 491 participating buildings after 4 years of operation. This equates to approximately 451 mtCO$_2$e reductions per participating building annually. We assume a Cincinnati 2030 District can attract 20 participating buildings in year 2018, 200 buildings by 2023, and 600 buildings by 2030.[31] [32]

2. Encourage population density and transit-oriented development in appropriate locations through zoning and incentives.

What is it and why is it important to Cincinnati?

The City of Cincinnati will focus regulatory tools and incentives on the goal of increasing density in appropriate locations. Increased density advances sustainability in several ways: residents of dense neighborhoods drive less because dense neighborhoods are walkable neighborhoods with more destinations nearby and more modes of travel available; residents of dense neighborhoods use less energy at home because their residences tend to be smaller than comparable suburban or rural homes; the residences are more likely to be adjacent to other temperature controlled spaces, reducing the loss of heat and AC to the outdoors; and residents of dense neighborhoods have easier access to green lifestyle amenities, such as curbside recycling, farmers markets, and community gardens.

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[31] (Green Building Alliance, 2016)

[32] (Griffiths-Sattenspiel, 2009)

Residents have shown that they are drawn to active, vibrant neighborhoods with shops, restaurants, and activities. As the City partners with developers to create denser neighborhoods, residents will choose a more sustainable lifestyle.

It will be a priority for dense neighborhoods to be diverse, mixed-income neighborhoods to provide access to quality services for every resident. Strategies to promote affordable housing will be needed. Increasing population density by zoning and incentives will allow for more centralized centers of shopping and business. More residents can move away from cars and move towards busses, walking, or biking to where they need to go. By focusing on transit-oriented development, the city will become more walkable and promote healthier modes of transportation for both the environment and the resident. Surface parking lots downtown should be discouraged to make way for higher density uses of the space, and minimum parking requirements should be reduced. Planning for parking garages to be convertible and used for non-parking purposes will be important. It will be a priority for the City to regularly assess parking needs and adjust accordingly as any new parking proposals are put forward. Population density frees up more land for farming and greenspace. Denser areas allow more people to have access to goods and services that might not be available to people with mobility challenges. Care must be taken to preserve existing and develop new low-income housing.

Providing incentives to encourage population density can benefit both the environment in which people live, and their finances. More centralized areas allow residents to spend less on transportation and put their money elsewhere. Reducing the need for private cars will address equity in terms of making services available to everyone.

Examples in Cincinnati and peer cities
- **Madison, WI**
  - Madison is attempting to encourage population density by introducing family friendly pocket parks and housing near the center of the city
  - http://host.madison.com/ct/news/data/wisconsin-population-trends-show-urban-areas-growing-rural-areas-shrinking/article_96978d1b-31c0-5def-8715-efde4e3700aa.html
- **Columbus, OH**
  - Columbus is trying to increase population density within the urban core by providing additional housing and encouraging jobs closer to the city core
  - http://createcolumb.us/priorities/amplify-the-urban-pulse/

Who will be taking the leading roles on this project?
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Who is the target audience?
- Suburban Residents
- Potential residents looking to move to Cincinnati
- Developers

What is the City of Cincinnati's role in implementation?

- The City will provide support for outside organizations while also working through the City Planning Department and the Community and Economic Development Department to create the best method of encouraging population density within the city

Is it Feasible?
- Feasibility: Medium
  - o Some peer cities have implemented population density plans that are effective.
  - o Many post-industrial cities are losing population.

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio
TBD (To City of Cincinnati)	TBD (To both property owners and City of Cincinnati)	TBD

There are multiple tools that can densify the urban core and neighborhood business districts in Cincinnati. Vacant buildings can be upgraded and put back into use. Infill development can put new buildings on vacant lots using the development network and current City programs.

Infill development will require the City to remove barriers to market activity. It will be important to examine limitations current zoning and other restrictions create. The City may need to act to make infill and renovation projects economically viable. Options include waiving Building Permit Fees for cases of infill development. For a typical residential (RCO) 3-family home that is valued at $100,000, demolition and excavation approvals cost $3,781 in fees[33] [1]. Another option is property tax abatement which would allow owners to pay a pre-improvement tax rate. The City of Cincinnati already has a program in place for this offering 10-year abatement terms or longer[34]. At a 5.6 mill (per thousand) tax rate the owner of the property would be responsible for $560 in property taxes annually. If the pre-improvement value of the property was $50,000 the owner would be responsible for $280/year in taxes, and the abatement would be worth $280/year.

Benefits include the tax revenue from the new structure once abatement expires. If the City can draw more residents from an increase in density we could expect an increase in income tax revenues. Infill development relieves the City of expenses to maintain vacant lots. These policies rely on tools the City already has and programs for larger developers which already exist. This also enables residents to preserve as much of the historic character of their neighborhoods as possible.

Keys to Equity:
- Encourage population density without gentrifying areas
- Reserve space for low income housing
- Provide incentives for low-income residents to move closer to the city center

Timeline for Implementation

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[33] (City of Cincinnati, 2017)
[34] (City of Cincinnati, 2017)

- This recommendation will take 4 to 5 years. First steps include working to adjust development codes to incentivize density.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
4,680 mtCO$_2$e	23,400 mtCO$_2$e	149,760 mtCO$_2$e

A national study of emissions by zip code estimates outer-ring suburbs of Cincinnati have a per capita carbon footprint (45.5 mtCO$_2$e) approximately 1.5 times the footprint of urban core residents (29.9 mtCO$_2$e). We assume policies to encourage density can attract 300 citizens a year to live in higher-density areas.

3. Improve City Facilities by investing in energy efficiency - specifically HVAC and lighting.

What is it and why is it important to Cincinnati?

Over the past 10 years, the City has performed deep energy retrofits on most of its buildings, reducing the City's utility bills by more than $2 million per year. Technology continues to improve, and many pieces of equipment that could not economically be replaced during the last retrofits are now at the end of their useful lives. It is time for the next round of energy retrofits in City Buildings.

The City of Cincinnati will work with Facility Managers in each building to create an energy efficiency plan that includes appropriate upgrades for building controls, HVAC systems, lighting, insulation, and air sealing. The City will renovate its buildings to become more energy efficient which will reduce costs and energy consumption for all City buildings. The recently created Revolving Energy Fund will be used to pay for much of the work. The Revolving Energy Fund will be paid back from the energy savings it produces, and the revolving funds will be used again.

Investing in energy efficiency within a building can provide large cuts in utility bills and reduce the greenhouse gases from producing the energy. By adding smart controls, the HVAC system can run more efficiently and only be active when needed. Providing frequent cleanings of the HVAC system is another simple way to improve their efficiency without large upfront costs. The City will continue to transition all City facilities to LED lights due to their durability and efficiency. LEDs last much longer than incandescent or fluorescent lamps while producing the same amount of light and using much less energy.

The City continues to be a role model for the private sector by staying at the leading edge of energy efficiency technologies in City buildings. As residents and companies see how much money is saved, they follow in the footsteps of the City. This upgrade in energy efficiency will reduce stress that is placed

on the grid during peak demand events, which will reduce the brownouts and blackouts that residents face.

Examples in Cincinnati and peer cities.
- **Denver, CO**
  - Denver has implemented energy efficiency upgrades including HVAC upgrades and LED lighting in its most well-known facilities such as the Denver Botanical Gardens: https://www.energystar.gov/buildings/about-us/how-can-we-help-you/communicate/energy-star-communications-toolkit/motivate-competition-4
- **Columbus, OH**
  - Columbus is reducing energy consumption within city facilities by upgrading their HVAC systems, installing Energy Star rated appliances, and replacing inefficient lighting fixtures: https://www.columbus.gov/getgreen/Key-Initiatives/

Who will be taking the leading roles on this project?
-

Who is the target audience?
- City Facilities

What is the City of Cincinnati's role in implementation?
- The City will own this recommendation and work with its building operators to implement energy efficiency upgrades in City buildings.

Is it Feasible?
- Feasibility: Easy
  - This continues ongoing work to make City facilities more efficient.

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio (5 year)
$5.17 sq./ft. (To City of Cincinnati)	$1.82 sq./ft. (annual) (To City of Cincinnati)	1.76

A study prepared for the Governor's Energy Office in Colorado (2007) conducted an analysis of 11 LEED facilities (which had energy efficiency enhancements on par with this recommendation) and detailed an average savings per square foot in each facility and an average cost premium, per square foot. These figures showed an average upfront cost premium of $5.17/square feet. and an annual benefit average of $1.82/square feet[35]. Improvements in the indoor environment within facilities can have many effects related to occupant safety, energy consumption reduction and improved productivity. According to a study of multiple public facilities in California, thermal energy loads decreased anywhere from 20%-60%.

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[35] (Enermodal Engineering, Inc., 2006)

This was achieved with a combination of individual temperature control systems (achieving an average of 43% reduction) and reducing HVAC energy demands via smaller zones sites, occupancy sensors and broadband set points; achieving an average of 14% reduction. Industry use of mixed mode HVAC systems can reduce energy consumption 40%-75%. It is also worth noting that many City owned HVAC systems will need retrofitting or replacement due to the phaseout of R-22 (see Built Environment Rec-9); this is a valuable opportunity for installation of enhanced systems, and given the nature of these required investments, these costs can be considered 'sunk'. Lighting and daylight response dimming, innovative control systems and high-quality fixtures can yield energy savings around 25%-90%.

Health and productivity of building occupants also improved. Reduced indoor pollution, improved acoustics, increased natural lighting and outside access yielded productivity increases from .2%-15%. High performance lighting alone is attributed to productivity increases ranging from 0.7-26%. Temperature controls show productivity improvements ranging from 0.2% up to 15%. A total of 17 studies found an improvement in health directly related to high air quality, ranging from 13.5% up to 87%. For high performance lighting, such as efficient lighting and use of indirect lighting fixtures, productivity gains ranged between from 0.7% and 26.1% in 11 studies[36].

Keys to Equity
- Share best practices with owners and managers of multi-family structures.
- Educate residents on how these upgrades can be implemented within their own home.

Timeline for Implementation
- This recommendation will take 3 to 4 years to implement. The first phase of retrofits will be completed in less than 1 year.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
2,578 mtCO$_2$e	12,891 mtCO$_2$e	82,496 mtCO$_2$e

City of Cincinnati building operations generated 257,828 mtCO$_2$e in 2015. We assume energy improvements to facilities can reduce building emissions 1% annually[37].

4. Encourage development of high-performance buildings.

What is it and why is it important to Cincinnati?

Choices made in the construction and redevelopment of a building will last for decades, can drastically impact building performance, occupants' satisfaction, and ultimately impact the overall value of the

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[36] (Alpin Limited, 2017)
[37] (City of Cincinnati, 2015)

building. High performance buildings dramatically exceed the performance of typical buildings in conserving energy, water, and storm water runoff. High performance buildings improve occupant health, productivity, and improve other performance characteristics of the facility as well.

One factor in deciding whether to incorporate green technologies and practices into a building is the initial cost of those items. The City of Cincinnati currently offers a tax abatement for renovations and new buildings that become LEED certified or complete the Living Building Challenge. Residents are also eligible for a tax abatement if they can document efficiency improvements based on a Home Energy Rating Score (HERS). With the tax abatement program, residents and builders are encouraged to build green because they save on both energy and taxes. This program will be pushed further by educating current and prospective building owners and residents about the advantages of sustainable and high-performing buildings. For example, the Energy Code requirements will be more readily available on the city's website which will help residents to build according to these codes. The page that contains the energy codes will also touch on other green opportunities such as LEED buildings and other sustainable building practices.

The City of Cincinnati is leading by example with its recent construction of the District Three Police Station (D3). D3 has been certified as a LEED Platinum building and is net zero energy meaning that over a year, the building will produce as much energy as it consumes. Over a 20-year building life cycle, the D3 facility will save almost 2 million dollars when compared to a traditional building.

Examples in Cincinnati and peer cities.
- Cincinnati District 3 Police Station
    o Cincinnati has created the world's first Net Zero police station that produces as much energy as it consumes through solar panels and numerous efficiency measures: https://www.cincinnati-oh.gov/police/news/cincinnati-opens-new-district-3-police-headquarters/
- PPG Paints Arena- Pittsburgh, PA
    o First LEED Gold sports venue in the country that could reduce its water consumption by 40% and energy consumption by 31% by following LEED guidelines: http://www.ppgpaintsarena.com/ppg-paints-arena/green

Who will be taking the leading roles on this project?
- Office of Environment and Sustainability
- Department of Community and Economic Development

Who is the target audience?
- Building owners
- Developers
- Residents

What is the City of Cincinnati's role in implementation?
- The City will be the primary entity implementing this recommendation through outreach to building owners and developers while partnering with outside organizations to spread the campaign

Is it Feasible?
- Feasibility: Easy
  - There are already numerous buildings within the city that have used the City's tax abatement program

How much would it cost?

Cost	Benefit	Cost Benefit Ratio
$ 200,000[38] (To property owners)	$ 737,424[39] (To property owners)	5.3:1[40]
	$ 66,000/yr.[41] (To property owners)	

The current City tax abatement for construction of buildings to LEED standards is a cost-effective incentive for developers to implement green building design standards. Tax exemptions reduce the operating expenses of a development project, thereby lowering the risk of the development and increasing the initial investment beyond what would have been possible without a tax exemption.

LEED buildings have 34 percent lower CO_2 emissions, consume 25 percent less energy and 11-15 percent less water than buildings built to code. The average expected increase in property value of a LEED certified property is 4 percent and green building projects typically pay for themselves in offset input costs in under seven years. Green buildings typically reduce maintenance costs by almost 20% and the first year after project completion typically yields a 10% reduction in operating costs. Nationwide, it is expected that green construction will produce over one million jobs and over $75 billion in wages in the coming years factoring down to roughly $68,727.27 per job created, almost double the median income in the City of Cincinnati.[42]

The tax abatement only applies to improvements to property and therefore the City should not expect to lose revenue over the policy. The total cost of the Tax Incentive/Enterprise zone which administers this program was $70,000 in 2017 and not expected to exceed $100,000 by 2023[43].

Keys to Equity:
- Educate building owners who house low income residents
- Target buildings located in underdeveloped and disadvantaged areas
- Implement in areas that are lacking high-efficiency buildings

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[38] Additional Cost of LEED for typical $10 million project at 2% premium
[39] Net present value of future year CRA tax abatement on $10 million increase in value.
[40] Counting net present value of tax abatement plus 5 years of annual savings.
[41] Typical LEED annual savings on energy and operations.
[42] (USGBC, 2016)
[43] (City of Cincinnati, 2017)

Timeline for Implementation
- This recommendation will be implemented within 1 to 2 years by spreading educational materials to buildings owners and operates to show the economic and environmental benefits of building more efficiently

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
1,754 mtCO$_2$e	11,495 mtCO$_2$e	73,568 mtCO$_2$e

LEED buildings have 34 percent lower CO$_2$ emissions than buildings built to standard code. In 2016, approximately 75 LEED certified projects were initiated or completed in Cincinnati, about 80% of those were residential homes, and 20 percent were commercial. We assume a median square footage of 2,466 for new home construction (average annual carbon output of 37.7 pounds CO$_2$e per square foot), 19,000 for new build commercial structures in the US (average annual carbon output of 32.4 pounds CO$_2$e per square foot). We assume 2016 is a typical year for LEED construction.[44][45][46]

5. Incorporate complete street principles in all new roadway and rehabilitation projects.

What is it and why is it important to Cincinnati?

The City's Department of Transportation and Engineering will work with partners to create more complete streets when streets are being built or rehabbed. "Complete streets" are defined as streets that can be used by everyone. By providing sidewalks, bike lanes, and travel lanes that accommodate buses, residents will be more inclined to use alternate modes of transportation to get to and from their destinations.

An important benefit of complete streets is safety. Complete streets provide the safest place for bikers to ride, walkers to walk, and cars and busses to drive without sacrificing the safety of any one of the three. Reducing the cars on the road will have a large impact on the City's carbon footprint. The increase in alternate, more healthy modes of transportation will promote more active lifestyles and encourage residents to burn calories, not carbon.

Complete streets improve equity by providing more methods of transportation for residents of all parts of the city. As bicycle and walking options becoming more available, residents will have access to more resources that were at one point unreachable due to lack of transportation. Special attention will be

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[44] (Energy Star, 2016)

[45] (U.S. EIA, 2015)

[46] (U.S. Census Bureau, 2017)

needed to ensure that complete streets are allocated appropriately to all neighborhoods. Besides the improvement of access, complete streets help reduce carbon emissions and provide a healthy alternative to driving cars.

There are some locations where a complete street design is difficult or expensive due to space limitations or existing patterns of development. Any decision not to incorporate complete-street principles will require approval.

Examples in Cincinnati and peer cities.
- **Madison, WI**
  - Madison is working to improve its transportation system and address neighborhood needs by incentivizing complete streets throughout designated neighborhoods: https://www.cityofmadison.com/sustainability/documents/SustainPlan2011.pdf
- **Minneapolis, MN**
  - Minneapolis is showing a commitment to pedestrians by implementing complete streets during all road improvement projects: http://www.minneapolismn.gov/www/groups/public/@citycoordinator/documents/images/wcms1p-093724.pdf

Who will be taking the leading roles on this project?
- Cincinnati Environmental Advisory Council

Who is the target audience?
- Pedestrians
- Bicyclists
- Department of Planning
- Transit Users

What is the City of Cincinnati's role in implementation?
- The City will own this recommendation and work with outside organizations to build complete streets that encourage residents to bike and walk instead of drive.

Is it Feasible?
- Feasibility: Medium
  - It has already been implemented throughout parts of the city and can be improved by looking at other peer cities efforts.
  - It adds cost, which might limit its use.

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio

$2.8 million/year[47] (To City of Cincinnati)	~$38.7 million (at scale) (To City of Cincinnati)	2.8:1[48]

Development of Complete Streets is considered to be a more holistic approach to transit infrastructure, designed for all users, not just vehicular travel. According to a line item analysis of complete streets, sidewalk construction adds an average 3% and bike lanes add around 5% to the overall project budget. These can be offset by creative allocation of space and as a result, materials. For example, the same study cited reduction of driver lanes by appropriate amounts (1 foot) can save 2% of the costs[49]. It is important to consider that complete streets are not an "additive approach" but one which requires tradeoffs between catering to multiple methods of transportation. Some projects cost more but others can cost less. Total cost reduction is a definite possibility in some cases.

Benefits include safer, more accessible streets. A project along a major arterial in Seattle, Aurora Avenue, decreased vehicular crashes 21%. Another in Seattle, Stone Way North, reduced speeding 75%, increased bike traffic 35% and collisions fell across the board, including an 80% reduction in pedestrian-involved collisions[50]. The state of Washington also found that rehabilitating highways to be 'complete' saved an average of $9 million per project and the City of Nashville, seeing these results, has consistently devoted 60% of its transportation budget to walking, biking and transit infrastructure, yielding similar results[51]. Bottom line analysis in Vermont showed complete streets yields business and community growth, added property value, and job creation. Revenue attributed to these streets extrapolated at a per capita rate to the scale of Cincinnati yields can help us estimate an increase of $38.7 million in revenue due to the construction of these streets.

Keys to Equity:
- Implement in areas with low car ownership
- Educate residents on alternative modes of transportation
- Focus on areas with low income residents who could benefit from less expensive modes of transportation

Timeline for Implementation
- This recommendation will take 3 to 4 years to become a consistent part of City practice, and longer to be incorporated into existing streets. Some first steps include identifying areas that could benefit from complete streets as well as working with neighborhood groups to educate them about pedestrian travel.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050

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[47] The City spends about $35 million/year on street rehabilitation and maintenance (including CAP funds). An 8% increase would be $2.8 million/year.
[48] Assumes 5 years of costs are needed to produce the benefit.
[49] (Shepard, 2012)
[50] (Smart Growth America & National Complete Streets Coalition, 2013)
[51] (National Complete Streets Coalition, 2011)

1,836 mtCO$_2$e	9,180 mtCO$_2$e	19,980 mtCO$_2$e

Currently 2.3% of Cincinnatians walk or bike to work. We assume improved walkability and bike ability will help increase this number to 4% over 5 years, and to 6% by 2050. We assume the average carbon generated by commute is 1.8 mtCO$_2$e per person annually.[52]

6. Target multi-family properties for energy efficiency improvements.

What is it and why is it important to Cincinnati?

Over 60% of Cincinnati households rent. Current energy efficiency programs offered by the City of Cincinnati, Duke Energy and many weatherization providers primarily target home owners. The split incentive between cost for efficiency improvements being born by the property owner and the resulting utility savings being received by the tenant creates a dichotomy where neither party is able to invest in efficiency. As a result, nothing gets done. Further, energy costs for low income individuals make up a disproportionate amount of their income. According to the U.S. Census, the average energy burden for low income households is 8.2%—three times as high as for non-low-income households. A study by the American Council for an energy-Efficient Economy indicated Cincinnati's low-income populations has the 9th highest energy burden in the US[53].

To address this issue, The City of Cincinnati will work with community stakeholders to develop educational and financing programs that will encourage multi-family properties to improve their energy efficiency and lower tenants' bills. Specific tools that could be investigated include PACE financing or other low interest financing tools, green leasing programs, LED light bulb give away programs. Educational tools for tenants such as Rent Rocket (or similar programs) will allow tenants to find properties that have made energy efficiency improvements. "Rent Rocket" is a website that allows landlords to put their houses on a map with other landlords that embrace energy efficiency and other sustainable practices. Enabling tenants to see the energy benefits of an efficient home will enable the market to reward owners of efficient homes with higher rents.

Intentional care must be made in program design so that improvements to the property do not result in significant increases in rent forcing current tenants to relocate.

Examples in Cincinnati and peer cities
- **Bloomington, IN**
  - Bloomington worked to create Rent Rocket which is a website that provides tenants with a place to look for utility costs, recycling options, modes of transportations, and other information to help decide where to live: http://www.rentrocket.org/about

Who will be taking the leading roles on this project?
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[52] (Regional Indicators Report, 2015)
[53] (ACEEE, 2016)

Who is the target audience?
- Multi-Family landlords and tenants

What is the City of Cincinnati's role in implementation?
- The City will provide support to an outside organization that educates landlords and tenants on how energy efficiency upgrades can reduce costs for both groups.

Is it Feasible?
- Feasibility: Medium
  - Cities similar to Cincinnati have already implemented it and there are energy efficiency programs already in place within Cincinnati that can be adjusted to fit landlords and tenants.
  - Improving energy efficiency in rental properties is a challenge for many communities.

How much would it cost?

Cost	Benefit	Cost Benefit Ratio
$3000[54] (To landlord)	$500 (annual) (To landlord)[55]	.8:1 in 5 years, 6-year ROI

- Costs would vary depending on what upgrades the landlords choose to make. There will be modest costs for educating landlords on energy efficiency projects and financing strategies.

Keys to Equity:
- Encourage landlords who serve low-income residents to participate.
- Educate residents on how to have this conversation with landlords.
- Provide financing options for low-income landlords and residents.

Timeline for Implementation
- This recommendation will take 1 to 2 years to implement. A first step is to educate landlords on the importance of energy efficiency to attract new renters to their properties

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
144 mtCO$_2$e	2,156 mtCO$_2$e	4,608 mtCO$_2$e

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[54] Average cost for energy efficiency retrofit for 1 residence.
[55] Average annual energy savings from 1 retrofit residence.

We assume an energy efficiency program targeted to multi-family properties would impact 30 buildings in a year. Average multi-family apartment size is assumed to be 934 square feet[56]. The average building is assumed to include 5 apartments. Emissions per square foot is assumed to be 37.7 pounds CO_2[57]. We assume buildings that undergo performance improvements will see an average of 10% annual energy savings.

7. Require all new City facilities to be LEED Silver certified or better.

What is it and why is it important to Cincinnati?

The City of Cincinnati will require all new City facilities to be built to a LEED Silver standard or higher. LEED is a world-wide accreditation system that encourages buildings to be built in the most sustainable fashion. The City already has LEED Certified buildings such as the District 3 Police Station. LEED buildings will reduce operating costs for the City as well as saving energy and reducing carbon emissions. City examples make the idea of embracing LEED more attractive to the private sector.

Building to LEED standards drastically reduces the cost of utilities and operations throughout the building. This allows the City to spend less money on operating costs. Buildings that are more efficient also help reduce the stress on the grid during peak demand periods.

Requiring all new City buildings to be built to LEED silver or better, coupled with backup power, allows the buildings to be used as emergency shelters when extreme weather events occur. By using less energy and producing their own, buildings can be used as cooling centers during extreme heat events. This increases equity because these buildings will provide places for low-income residents to go who may not have air conditioners in their home.

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[56] (Energy Star, 2016)
[57] (Otet, 2016)

Case Study: Country's first Net-Zero Police Station – District 3

The new District 3 Police Station is a LEED Platinum and Net Zero Energy facility. The building generates as much energy as it consumes. It is one of the most sustainable public safety buildings in the country. Among the green features of this facility are solar panels to produce electricity, geothermal heating and cooling, LED lighting, super-insulating triple pane (bullet proof) windows, and bio-swales that capture and hold rainwater. The facility uses less than 50% of the energy required to operate a typical 24/7 public safety building of this size and is the workplace of over 200 employees.

Further Reading: https://www.cincinnati-oh.gov/police/news/cincinnati-opens-new-district-3-police-headquarters/

Examples in Cincinnati and peer cities
- **Portland, OR**
  - Portland requires all new municipal buildings to be built to at least LEED Gold and all interior renovations to be at least LEED silver: https://energy.gov/savings/city-portland-green-building-policy-and-leed-certification
- **Austin, TX**
  - Austin requires all city projects to be built to at least LEED silver: https://data.austintexas.gov/stories/s/Office-of-Sustainability-Dashboard/5t5d-xrry

Who will be taking the leading roles on this project?
- Department of Public Services (Facilities)

Who is the target audience?

- City Facilities
- City Building Operators

What is the City of Cincinnati's role in implementation?
- The City will own this recommendation and work to make it standard that City facilities are built to LEED Silver or better.

Is it Feasible?
- Feasibility: Easy
  - Peer cities have already implemented similar requirements and Cincinnati already has several LEED certified buildings.

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio
1-6% upfront premium (To City of Cincinnati)	30% ongoing cost savings (To City of Cincinnati)	5:1 to 30:1

A comprehensive analysis was completed by Alpin Limited using educational facilities and multiple studies of municipal buildings in California which had achieved varying levels of LEED standards. Reduction of inputs to building function were documented, when compared to conventional design requirements; average energy reduction of 33% which equates to a savings of $0.38/square foot per year. Similar savings in indoor environmental factors were found; thermal energy loads decreased anywhere from 20%-60%. This was achieved with a combination of individual temperature control systems (achieving an average of 43% reduction) and reducing HVAC energy demands achieving an average of 14% reduction. Alpin noted that mixed mode HVAC can reduce energy consumption 40%-75%. Lighting and daylight response dimming can yield energy savings around 25%-90%.

For the structures examined there was a reduction of water use by 32% yielding monetary savings up to 39%. Operations and maintenance benefits amounted to an average of $8/square foot over a 20-year period for 40 California state agencies examined. Health and productivity of building occupants also improved; reduced indoor pollution, improved acoustics, increased natural lighting and outside access yielded productivity increases from .2%-15%. High performance lighting alone is attributed to productivity increases ranging from 0.7-26%.

A study of 11 LEED facilities in Colorado conducted by the Governor's Office of Energy Management & Conservation in 2011 found the premium for certification ranged from 1%-6% of construction costs for nine of eleven projects. The study also revealed the net present value of energy savings associated with the project energy efficiency measures offset the LEED soft and hard costs in 70% of the projects studied.

An important final note is that returns from LEED implementation usually increased with higher levels of certification, which is why LEED Silver is specified. The LEED system does not certify solely based on energy savings but rather relies on a point system valuing multiple criteria. This is in many ways an

advantage; it allows improvements to be made at the discretion of developers, but also prohibits true comparative analysis due to the diversity of LEED certifications. [58] [59] [60] [61]

Keys to Equity:
- Build facilities that serve the poor and underserved
- Provide construction jobs to disadvantaged individuals within the neighborhood

Timeline for Implementation
- A LEED Silver requirement can be enacted in 1 year.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
95 mtCO$_2$e	190 mtCO$_2$e	570 mtCO$_2$e

LEED buildings have 34 percent lower CO$_2$ emissions than buildings built to standard code. We assume an average size of 19,000 sq. ft. for new build commercial structures in the US, with average annual carbon output of 32.4 pounds CO$_2$e per square foot. We assume the City of Cincinnati will build one new building every five years.[62] [63]

8. Develop a plan to return vacant buildings to productive use.

What is it and why is it important to Cincinnati?

The City of Cincinnati will work with partner organizations to create a plan to return vacant existing buildings to productive use. This will allow areas that might otherwise be developed to be left for natural uses such as wetlands while vacant buildings can be revived and remodeled at less cost.

The City will provide incentives and educational material to encourage developers and prospective owner/occupants to use existing buildings and renovate them. A plan will be created that includes identifying salvageable vacant buildings and providing this list to developers and potential homesteaders. Educational materials that explain the environmental impact of reusing a vacant building as well as some of the economic costs and benefits will be provided to encourage use of vacant buildings.

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[58] (Alpin Limited, 2017)

[59] (NBI, 2008)

[60] (Scotfield, 2009)

[61] (Vande Hoef, 2011)

[62] (Energy Star, 2016)

[63] (U.S. EIA, 2015)

To make this as equitable as possible, all buildings will be considered including those in disadvantaged and low-income areas. Monetary incentives will be considered in the plan so that homesteaders have access to these buildings and the funds to renovate them.

Examples in Cincinnati and peer cities

Case Study: Heckman House

Photo courtesy of OTR A.D.O.P.T.

OTR A.D.O.P.T. is a non-profit which locates vacant properties and those scheduled for demolition working to preserve the architectural history of the City. The proprietor, Danny Klingler has worked to match properties with adopters who share his community orientation and ability to accomplish the restoration projects. One such partnership surrounded a vacant property on Lang Street purchased by Kristin and Chris Heckman, which is being rehabbed to achieve LEED Platinum.

- **St. Louis, MO**
  - St. Louis is working to clean up and prepare 40 vacant sites to be redeveloped: https://www.stlouis-mo.gov/government/departments/mayor/documents/upload/Mayor-Slay-Sustainability-Action-Agenda_2013-2018_8-5x11.pdf

Who will be taking the leading roles on this project?

Who is the target audience?
- Developers
- Potential Homesteaders

What is the City of Cincinnati's role in implementation?
● The City will own this recommendation and welcome assistance from partner organizations to create this plan.

Is it Feasible?
● Feasibility: Hard
  ○ Peer cities have implemented similar plans and Hamilton County has implemented a program that works to return vacant buildings to productive use.
  ○ Many buildings are vacant because the cost of repairs substantially exceeds the value of the repaired building.

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio
Nominal (To City of Cincinnati)	TBD (To City of Cincinnati)	TBD

Costs are nominal and administrative to develop a plan to reuse vacant buildings. Costs for various financial means to incentivize vacant building reuse, such as tax abatement, fee cancellation or others, can be assessed as part of the plan, but usually will consist of waiving revenue that the City would otherwise derive from the project.

Keys to Equity:
● Educate developers on advantages of reusing buildings
● Provide incentives so that developers can afford to renovate vacant properties
● Create a homesteading program that enables people who renovate and occupy vacant buildings to get ownership.
● Partner with disadvantaged communities where people with construction skills are underemployed.

Timeline for Implementation
● This recommendation will take 1 to 2 years to implement.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
20 mtCO$_2$e	100 mtCO$_2$e	100 mtCO$_2$e

The National Trust for Historic Places has analyzed the emissions associated with new construction process compared to the restoration of an existing structure. They reported new construction to emit approximately 1 additional kgCO$_2$e per square foot as compared to restoration. We assume 10

structures per year restored to habitation in 2018, with an average size of 2,000 square feet, growing to 50 structures per year by 2023.[64]

9. Require or incentivize Low Impact Development for new developments and infrastructure.

What is it and why is it important to Cincinnati?

The City of Cincinnati, in 2017, received three 100-year rain events causing flooding and property damage more than 30 million dollars. In addition, MSD is under a $3.1 billion consent decree to reduce the raw sewage and storm water from combined sewers overflowing into the surrounding waterways. Low impact development (LID), and similar landscape design systems such as Keyline Design, refer to systems or practices that mimic natural processes that result in the infiltration, evapotranspiration, and general reduction in storm water to protect water quality. Implementing LID is one way to reduce costs associated with required sewer improvements and to address increased storm events associated with a changing climate.

Low Impact Development will encourage developers and building owners to implement technologies that address storm water management both in the buildings and the supporting infrastructure. Low Impact Development will help manage storm water during normal rainfalls and much bigger storm events by reducing impervious surfaces, or diverting rain into storm collection areas such as rain barrels, retention ponds or rain gardens.

Residents will benefit from the development because storm water will be diverted to a collection area reducing sewer backups and potential impacts of flash flooding. Special attention should be paid to target disadvantaged communities who are often in topographically sensitive areas and especially susceptible to the negative impacts of storm water.

The City of Cincinnati will work with outside organizations to promote, incentivize, and possibly require Low Impact Development strategies for new developments within the city. Existing facilities may need to be retrofitted.

Examples in Cincinnati and peer cities
- Cincinnati District 3 Police Station
  - Cincinnati's LEED Platinum police station uses native vegetation and on-site water features to retain storm water on the property: https://www.cincinnati-oh.gov/police/news/cincinnati-opens-new-district-3-police-headquarters/
- Boston, MA
  - The City of Boston has incorporated a green roof on the city hall to help reduce storm water runoff while reducing energy costs: http://www.mass.gov/eea/docs/czm/cwq/smartgrowth/boston-lid.pdf

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[64] (National Trust for Historic Preservation, 2016)

Who will be taking the leading roles on this project?
- Department of Planning
- Department of Building and Inspections

Who is the target audience?
- Land developers
- Building owners
- Residents

What is the City of Cincinnati's role in implementation?
- The City will own this recommendation and rely on assistance from outside organizations to help educate and promote LID. The City will be responsible for changing building codes to make LID a larger part of the process.

Is it Feasible?
- Feasibility: Easy
  - There are many examples of LID that can be found throughout the city already.

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio
$1,084,000/project (To developers)	$1,331,000/project (To developers)	1.19:1

An EPA study of 13 projects compared the cost of LID to conventional storm water management. The study found that conventional storm water management cost an average of $1,331,000 for the projects, while LID costs averaged $1,084,000, which is 19% less.[65]

Keys to Equity:
- Implementing low impact development strategies in disadvantaged areas
- Educate residents on best uses for low impact development and how it will save them money and resources

Timeline for Implementation
- This recommendation can be implemented in 2 to 3 years. The first steps include changing storm water regulations to require low impact development on all new developments.

Greenhouse Gas Impact

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[65] (U.S. EPA, 2007)

This recommendation is intended to prevent storm water runoff and damage. The greenhouse gas benefits are nominal.

10. Implement a Coordinated Site Plan Review Process.

What is it and why is it important to Cincinnati?

The City of Cincinnati is currently implementing a Site Plan Review Process that will encourage communication between departments during approval of new building construction. This will help eliminate costly revisions and clarify for applicants what is expected ahead of time. This process should consider site conditions that contribute to risk of flooding and storm water issues, and or/contribute to the storm-related risks of nearby properties.

The City's Office of Performance and Data Analytics will lead a multi-department work group to create a new process.

Applicants will benefit from this revised process because they will know what needs to be submitted to move on to the next steps. The new process allows for the City departments and applicants to work with the same information, removing any confusion on which information is relevant. This process will also help to measure the timeliness of the City's response to applications.

Examples in Cincinnati and peer cities
- **Columbus, OH**
  - Columbus has worked to implement an online system that manages documents for city plan submissions and reviews: https://www.columbus.gov/utilities/water-protection/environmental-management-system/Service-Provider-Responsibilities/

Who will be taking the leading roles on this project?
- Department of Planning

Who is the target audience?
- City Departments
- Building applicants

What is the City of Cincinnati's role in implementation?
- The City will own this recommendation and work to create more clarity throughout the application process by creating a committee to oversee submissions and provide a checklist for all applicants.

Is it Feasible?
- Feasibility: Easy

     o   The City is using an existing process to base its new review plan on.

How much would it cost?

Cost	Benefit	Cost Benefit Ratio
Nominal[66]	TBD	TBD

Keys to Equity
- The process should provide safeguards for existing neighborhoods and a voice for neighbors in the Site Plan Review Process.

Timeline for Implementation
- This recommendation will be implemented in 1 year.

Greenhouse Gas Impact

This recommendation is intended to prevent storm water runoff and damage. The greenhouse gas benefits are nominal.

11. Plan to phase out HVAC systems using R-22.

What is it and why is it important to Cincinnati?

The City of Cincinnati will work with partners to phase out older Heating, Ventilation and Air Conditioning (HVAC) systems that are using R-22. R-22 is linked to depletion of the ozone layer. R-22 is a greenhouse gas that is 1500 times more potent than CO_2. R-22 has been eliminated from new HVAC systems since 2010. Production of R-22 is phasing out and will be prohibited after 2020. Service to R-22 systems after 2020 will be based solely on recycled and reclaimed R-22 materials.

The City will develop a schedule to eliminate R-22 from existing City facilities and will change out the HVAC systems when renovating buildings. All new City buildings will use climate friendly refrigerants. It is important to switch out refrigerants for economic as well as environmental reasons because the prices for service to R-22 systems have gone up greatly due to limited products. The City can replace R-22 systems with much more efficient HVAC systems that will reduce energy consumption, provide cost savings, and be free of ozone-depleting refrigerants. The private sector will also make the switch due to tax breaks and refunds that help encourage the use of more efficient systems.

Tax breaks and refunds will provide more incentives for both public firms and private homes to make the switch. Everyone will be able to take advantage of these costs savings, even those who could not originally afford to update or buy a new HVAC system for their home. The phase out of R-22 allows for the City to remove potentially harmful chemicals from its buildings.

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[66] The only costs will be employee time to develop and staff the new process.

Some experts believe that proper management of refrigerants is the single most impactful thing that can be done to reduce climate change.[67]

Examples in Cincinnati and peer cities
- **Columbus, OH**
  - Columbus is working to improve energy efficiency in city facilities by upgrading all HVAC systems to be Energy Star certified and remove any harmful refrigerants that are housed in older units: https://www.columbus.gov/getgreen/Key-Initiatives/

Who will be taking the leading roles on this project?
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Who is the target audience?
- City Facility operators

What is the City of Cincinnati's role in implementation?
- The City will own this recommendation and work to eliminate remaining R-22 systems.

Is it Feasible?
- Feasibility: Medium
  - While other peer cities are performing upgrades to their HVAC systems, none are specifically targeting R-22.

How much would it cost?

Cost Replacement of typical 7.5-ton RTU	Benefit vs typical 1990's unit	Cost-Benefit Ratio 5 yrs.
$7,500 (To City of Cincinnati)[68]	$1,500 yr. (To City of Cincinnati)	1:1

Phaseout of usage of refrigerant substances labelled as Class II ozone-depleting substances (ODS) by the US EPA is required by federal law in accordance with the Montreal Protocol. Class II substances are transitional and only intended for use for a limited duration. R-22 is a chemical (Freon) HCFC which this mandate applies to and is used in City facilities. By 2030 the United States is required to eliminate production, import and use of all Class II substances[69].

HVAC replacement can immediately lower energy costs by roughly 40% and will also eliminate most maintenance costs for the near future[70]. HVAC equipment lifespan may be as short as 10-15 years so accelerating replacement may reduce disruptions. New high-efficiency equipment yields a 15% return

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[67] (Project Drawdown, 2017)
[68] (Lennox Industries Inc., 2017)
[69] (U.S. EPA, 2017)
[70] (Lennox Industries Inc., 2017)

on investment[71]. Factoring in lower maintenance costs and limiting future repairs (which likely cause productivity declines), payback can be achieved in around three years.

There are substitute chemicals which can be used in lieu of Freon R-22. A 'drop in' substitute to R-22 is MO-99 which can be used on existing R-22 equipment. This is a good short-term measure for equipment which does not require immediate replacement. Another alternative, R-410A (Puron) HFC, has a higher operating pressure. To use R-410A, facilities will likely need new equipment. R-410A can be anywhere from 16-80 times as expensive as MO-99, factoring in the need for new equipment and installation associated with R-410A[72]. Notwithstanding, R-410A is the industry consensus 'green alternative' due to the composition of the chemical[73]. In addition to mitigating ozone depletion, R-410A is considered a better conductor of heat.

Keys to Equity:
- Dispose of the R-22 responsibly
- Prevent dumping the excess is disadvantaged areas
- Educate residents on why it is important to get rid of R-22 and upgrade to energy efficient HVAC systems

Timeline for Implementation
- This recommendation will take 3 to 5 years to implement. The phase in will start with units already needing replacement.

Greenhouse Gas Impact

City of Cincinnati is conducting an inventory of R-22 used by City facilities.

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[71] (Knapp Schmidtt Architects, LLC, 2017)

[72] (The Chemours Company, 2017)

[73] (Daizuki, 2017).

EDUCATION & OUTREACH

Supporting formal and informal learning about sustainability and equity

"Unless someone like you cares a whole awful lot, nothing is going to get better. It's not."
-Dr. Seuss, the Lorax

The Queen City is filled with opportunities to learn about sustainable behavior – from the Greenest Zoo in America, to the region's sustainability alliance in Green Umbrella, to the numerous environmental education programs available through the Cincinnati Nature Center, Great Parks of Hamilton County, Cincinnati Parks, the Civic Garden Center, Keep Cincinnati Beautiful, local schools, universities and more. However, when it comes to sustainable behaviors, we recognize that nothing will get better - change will not occur - if we can't find the inspiration to change ourselves. Accessible education is key to inspiring Cincinnatians to make sustainable behavior choices and be stewards of the environment.

Voice and participation are among the most important aspects of education. We would not be a comprehensive task team without the input, perspective, and expertise of our community. Therefore, we asked our Cincinnati community to share their voice, ideas, and passion for education and advocacy regarding the Green Cincinnati Plan. Task team meetings, written suggestions and feedback, conversations with experts in the field, were all included in this input and development process.

Together we identified a range of opportunities for encouraging, incentivizing, and educating about sustainable behavior change. This plan outlines these strategies, which include engaging the business community and neighborhoods through green certification programs; supporting public/private partnerships to help train and attract the next generation of sustainability professionals; developing a sustainability fund; and building a green business incubator.

Research and experience shows that behavior change can and does happen – especially with education and communication. A key to this plan's success will be effective outreach and engagement of our communities. We must tell our sustainability story, and show how easy it is to be a part of it!

Fia Turczynewycz
Cincinnati Zoo
Education Team Lead

Goals

1) REGISTER 100 ORGANIZATIONS IN A GREEN BUSINESS/NEIGHBORHOOD CERTIFICATION PROGRAM.

2) ESTABLISH $1M IN A GREEN CINCINNATI FUND TO ADVANCE SUSTAINABILITY INITIATIVES.

3) INCREASE BY 10% THE NUMBER OF CITY RESIDENTS THAT CAN NAME AT LEAST 3 ACTIONS THEY ARE DOING TO BE GREEN/PROMOTE SUSTAINABILITY.

Recommendations

Many of the recommendations of this plan are inter-related, and have multiple benefits. Education & Outreach are critical to nearly all recommendations in the Green Cincinnati Plan. Therefore, cross-references to education-related provisions in other chapters are not provided.

1. Install solar panels on Cincinnati Public Schools facilities.

What is it and why is it important to Cincinnati?

The City of Cincinnati will work with Cincinnati Public Schools (CPS) to identify opportunities to install solar panels on school facilities for renewable energy generation. CPS can greatly reduce their carbon emissions by using the roofs of their facilities to generate energy that can be fed into the building, and potentially reduce operating costs. The City will work with CPS to explore financing options to implement solar with minimal cost. Solar panels can be incorporated into school curricula to serve as an educational tool for students of all ages and in many different disciplines.

Examples in Cincinnati and peer cities.

- North College Hill High School (North College Hill City School District)
  - o System Size: 50.4 kW
  - o Year Installed: 2011
  - o Provides 5% of total school power
- Tucson Unified School District (top in the nation, on-site generation)
  - o Annual Solar Power Usage: 22,056,172 kWh (on-site generation)
  - o Provides 25% of total school district power
- Arlington County Public Schools (example in climate/weather more like OH)
  - o Public school system with 36 campuses and several support buildings
  - o Annual Solar (and some wind) Power Usage: 5,342,483 kWh
    - ▪ On-site generation: 734,483 kWh
    - ▪ Green Pricing: 4,608,000

- o   Provides 10% of total school district power

Who will be taking the leading roles on this project?

- ● The City will work with CPS to explore feasibility and financing.

Who is the target audience?

- ● CPS facility managers
- ● CPS administrators

What is the City of Cincinnati's role in implementation?

The City will work to aid CPS in adding solar panels by educating them on different financing methods to reduce the cost as well as helping to promote the solar panels and the benefits that come along with them.

Is it Feasible?

- ● Feasibility: Medium
  - o   This recommendation will be moderately difficult. The technology and economics work, but each project has its own site-related issues and requires leadership support.

 How much would it cost?

Cost	Benefit	Cost Benefit Ratio
$10-12 million after tax credits	$1.24 million/year	8-10-year ROI

Constructing 10 MW of solar on school facilities is expected to cost approximately $10M after federal tax incentives. It is expected to produce 13 million kWh of electricity per year. This gives the energy generated by the solar panels a value of $1.24 million per year[74]. Financing for the solar installations may be accomplished through a variety of financing options or ownership structures. If owned by a private entity, the solar array will be eligible for a 30% federal tax credit and other tax benefits, substantially reducing the price[75].

Keys to Equity:

- ● Implement throughout different parts of the city
- ● Promote panels on elementary, middle, and high schools

Timeline for Implementation

- ● This recommendation will take 3 to 4 years to implement.

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[74] (Fu, 2016)

[75] (DSIRE, 2016)

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
0 mtCO$_2$e	9,500 mtCO$_2$e	9,500 mtCO$_2$e

The 10 MW solar array will not be completed in 2018. When completed in 2019-2020, the arrays will abate approximately 9,500 mtCO$_2$e annually.

2. Outreach to multi-family buildings to educate residents of sustainability programs and benefits.

What is it and why is it important to Cincinnati?

Cincinnati has many multi-family structures, including apartment buildings and condos. Multi-family structures present unique challenges for sustainability programs, especially when the occupants are low income tenants, and when the buildings have high turnover rates. Common communication tools like postcards, door hangers, utility bill inserts, and door-knocking often fail to reach multi-family tenants. Due to their inaccessibility, multi-family tenants can be less aware of sustainable efforts, such as recycling. City programs are often targeted at the property owner. The City must work with property owners to have them educate their residents.

The City will develop an educational campaign for multi-family buildings to inform residents of the money saving opportunities and environmental benefits of pursuing a green lifestyle. Living "green" often simply means conserving resources and thinking of the impact of everyday behaviors. The City will target both residents and property owners with this program. Encouraging green lifestyles for residents creates money saving opportunities for property owners, giving them an incentive to educate their tenants.

Landlords can incentivize behaviors like recycling, which reduce the landlord's cost for trash removal, by offering reduced monthly rates for residents who practice green behaviors. For low income residents, this gives them an easy way to put a little bit of money back in their pockets each week. Pursuing these educational programs will help to make Cincinnati a more sustainable City, offering residents health, lifestyle, and economic benefits.

Examples in Cincinnati and Peer Cities
- Madison, WI
  - The City of Madison is working to educate developers and the community on the existing models of mixed-use multi-family buildings with a special focus on providing support for low-income residents.

- Pittsburgh, PA
  - The City of Pittsburgh is working with landlords of commercial and multifamily residential buildings to engage them with energy conservation programming.

Who will be taking the leading roles on this project?
- Cincinnati Environmental Advisory Council

Who is the target audience?
- Owners of multi-family dwellings
- Building managers of multi-family dwellings
- Residents of multi-family dwellings

What is the City of Cincinnati's role in implementation?
- The City of Cincinnati will work with building owners and building managers to encourage sustainable behavior by tenants. The City will work with these partners to create educational campaigns that specifically target residents in multi-family dwellings and the unique challenges they face when trying to live more sustainably.

Is it feasible?
- Feasibility: Hard
  - Much of the City's existing programming around sustainable behaviors is geared toward home owners. New programming will have to be created that specifically addresses the unique issues faced by residents of multi-family dwellings.
- Obstacles:
  - When addressing the issues in multi-family dwellings, it can be difficult to connect directly with the residents. Therefore, the City must work with local partners to create incentives for landlords to educate their tenants about the benefits of living more sustainably.

How much will it cost?

Cost	Benefit	Cost-Benefit Ratio
$40,000 (To City of Cincinnati)	$144,000 (To City of Cincinnati)	1: 3.5

To implement sustainability programming for multi-family dwellings, the City may hire a part-time employee to lead the campaign. The cost of the employee would be $25,000. There will be an additional $15,000 given to create signage, handouts, and programming for multi-family buildings. This brings the total cost to $40,000 to implement this recommendation.

Because of the City's door knocking campaign to increase recycling rates in neighborhoods, there was a 4% increase in recycling rates from face to face conversations. We would expect to see similar results in a campaign targeted at multi-family dwellings. There are currently about 60,000 occupied residences in multi-family structures in Cincinnati. If 4% of those residences, 2,400 households, decrease their energy use by 10%, they would save $60 annually. $60 of savings across 2,400 households would result in $144,000 of savings for Cincinnati residents.

Keys to Equity

For residents living in multi-family dwellings who are struggling to put food on their tables or pay rent month to month, education around sustainable habits can help them to reduce their monthly costs. This is especially true for those tenants who pay their own electricity and water bills because living sustainably means using less of these resources. Some landlords may offer small incentives to those who do things such as recycling because it is cheaper for the landlord to send waste to the recycling plant rather than the landfill.

Timeline for implementation
- Expected: 3 - 4 years
  - The first step will be to educate landlords and building managers on the benefits of making their buildings more sustainable. The City can then use those partnerships to directly reach out to the families of multi-family dwellings to educate them of the benefits they can receive from living a more sustainable lifestyle.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
960 $mtCO_2e$	960 $mtCO_2e$	960 $mtCO_2e$

This recommendation will help reduce the greenhouse gas footprint of multi-family buildings in Cincinnati by reduce greenhouse gas emissions from the energy and water sectors.

Because of the City's door knocking campaign to increase recycling rates in neighborhoods, there was a 4% increase in recycling rates. We would expect to see similar results in a campaign targeted at multi-family dwellings and energy usage. There are currently about 60,000 occupied residences in multi-family structures in Cincinnati. If 4% of these households reduced their energy use by 10%, it would eliminate 960 tons of CO_2 emissions each year.

3. Create a "Green Cincinnati Fund" to finance sustainability initiatives.

What is it and why is it important to Cincinnati?

The purpose of the Green Cincinnati Fund (GCF) will be to support the implementation of the Green Cincinnati Plan and to finance sustainability initiatives perpetually into the future. Funds will be raised through regional partners including institutions, corporations, foundations and community members. Separation of the GCF from the municipal budget will ensure that funds are used to transform Cincinnati into a green city. The GCF would: assist in gap financing for sustainability projects; support environmental education, boosting City's ability to communicate new sustainability initiatives; and assist the region in development of built environment, new transit opportunities, community outreach and to further enhance our natural systems.

The Fund will be administered by the Greater Cincinnati Foundation in partnership with the Office of Environment and Sustainability. A professional fundraising associate may help to facilitate generation of funds, at least to get the GCF started. The GCF would give the Office of Environment and Sustainability greater flexibility in project selection, planning and execution.

Who will be taking the leading roles on this project?
- Office of Environment and Sustainability
- Cincinnati Environmental Advisory Council

Who is the target audience?
- Individual and Institutional donors

What is the City of Cincinnati's role in implementation?

The City will work with partners to form the GCF, secure contributions, and oversee the use of funds.

Is it Feasible?
- Feasibility: Easy
  - A feasibility study commissioned by the Office of Environment and Sustainability determined that there is sufficient interest in the philanthropic community to justify creating the GCF.
- Obstacles:
  - The City will need to have clear parameters for where the money is going and what it takes for one to receive funding. Few people will be willing to donate not knowing where their money is going.

How much would it cost?

Cost	Benefit	Cost Benefit Ratio
$25,000 (To City of Cincinnati or independent fund)	$100,000 (To the Sustainability Fund)	1:4

Cost is based on a half-time fundraiser
Benefits are based on the findings of a feasibility study

The GCF would rely on donations for its funding. There are very little direct costs to City Government. Hiring a professional fundraising consultant would enhance the ability of the Fund to attract donations, especially at the outset, but is not imperative. Green financing and sustainability related projects are likely to attract donors with knowledge in the field and donors are likely to want to hear from the person who has a detailed understanding of where the money is going and how that would benefit the community and region. A fundraising professional may not be as well versed in these areas of expertise. It is likely that the largest costs are the time devoted by the administrator(s) of the fund for both

establishment and fundraising. A feasibility report was conducted in 2014 which concluded that it was likely that the GCF would raise at least $100,000.[76]

Keys to Equity

The GCF is a mechanism to finance the implementation of other recommendations in the Green Cincinnati Plan. If the Plan is successful in addressing equity, then the work funded by the GCF will address equity.

Timeline for Implementation
- Expected: 1 - 2 years
  - The target is to create the fund and receive initial contributions within the first year following adoption of the Plan. The assets of the Fund and impact of the Fund are expected to grow over time.

Greenhouse Gas Impact

The GCF will help to implement other recommendations in the Plan. It does not have a direct effect on GHG emissions.

4. Develop a Green Business/Neighborhood Certification program.

What is it and why is it important to Cincinnati?

A Green Business/Neighborhood Certification and Recognition program will provide institutions, businesses, organizations and individuals an opportunity to be recognized for practicing sustainable behaviors. The program will provide participants with tools and resources they need to lower their impact on the environment and adopt green practices. It will offer sustainability recommendations specifically crafted to the needs of each member. New members will make pledges to lower water use, reduce waste, conserve energy and make overall efforts to live and work in a more sustainable way.

The program will host events and offer educational services to spread awareness and offer suggestions on the best ways to go green. Many people do not live green lifestyles because they do not see the immediate benefits. Through the education of its members, the program will provide people a reason to live sustainably and raise awareness throughout the City. Sustainable practices encouraged by this program will help reduce costs by improving efficiency, creating benefits for participants and the environment.

For businesses and institutions, being awarded the status of a green organization will provide positive press and recognition among Cincinnati communities. This identification will attract new customers and allow organizations to educate those that visit about the benefits of sustainable practices.

Sustainability is a grassroots movement. All members of a green recognition program will be advocates for sustainability for their peers, clients, and friends. Creating a program that is open to everyone will

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[76] (Seth Walsh Consulting LLC, 2014)

spread sustainable practices throughout the City and help to make Cincinnati a better place to live. The Columbus Green Spot Program and Dayton Bring Your Green Challenge are two examples of successful Green Business Certification/Recognition programs.

Examples in Cincinnati and Peer Cities
- Columbus, OH
  - Green Spot
- Dayton, OH
  - Bring Your Green

Who will be taking the leading roles on this project?
- Office of Environment and Sustainability
- Cincinnati Environmental Advisory Council

Who is the target audience?
- Businesses
- Residents
- Institutions

What is the City of Cincinnati's role in implementation?
The City of Cincinnati and partners will recognize businesses, organizations, and residents who are achieving sustainable practices and make these recognitions public knowledge so these organizations and individuals can be recognized for their accomplishments.

Is it feasible?
- Feasibility: Medium
  - The City will be able to develop a green certification program, but it will take time to ensure this certification is recognized City-wide and carries significance.
- Obstacles:
  - There are many different green initiatives being pursued by individuals and organizations throughout the City with new projects being started every day. The City will have to effectively advertise their certification program to ensure that new green practices are identified and receive the recognition they deserve.

How much will it cost?

Cost	Benefit	Cost-Benefit Ratio
~$25,000 (To City of Cincinnati)	TBD (To City of Cincinnati)	NA

The State of California provides a resource to localities regarding establishment of a certification program. They include a mock budget based on the Monterey Bay Area[77]. The budget called for 10 different funding mechanisms totaling roughly $37,500 annually. Directly scaling this number to Cincinnati's population totals $26,640. A -8% cost of living adjustment brings the number down to $24,508. To fully fund through fees at $100 membership rates would require ~246 members.

Keys to Equity

A green certification program would encourage residents and businesses to strive to be sustainable, who otherwise may not have done it on their own. Being recognized as a green organization can provide businesses with recognition and help them attract new customers to grow their business.

Special efforts will be made to recruit small and minority owned businesses, and to tell their success stories.

Timeline for implementation
- Expected: 1 - 2 years

Greenhouse Gas Impact

Greenhouse gas reduction benefits from a green business or green neighborhood certification program will be difficult to quantify but may come from reduced water use, reduced waste, increased use of local food and/or reduced meat consumption, reduced energy consumption, increased use of renewable energy, or, most likely, a combination of many of these.

5. Expand workforce development opportunities, with an emphasis on students and low-income residents, through a City-University-Corporate Partnership for Education and Training.

What is it and why is it important to Cincinnati?

The City of Cincinnati is increasingly gaining recognition at a national level for being a sustainable city. The number of green jobs in Cincinnati is growing twice as fast as other employment. To maintain this status, we must train and attract the next generation of sustainability professionals. Special attention should be given to career development opportunities for low-income residents to ensure equitable access to education and training for green jobs. The City can build upon the groundwork already in place via the Hand Up Initiative, which is a mix of job readiness and job training programs designed to help long-term under or unemployed individuals transition to employment. A City-University-Corporate Partnership for Education and Training would create further opportunities that will keep Cincinnati at the forefront of sustainable cities. The Partnership will provide a space for members to collaborate and work together to secure Cincinnati as a hub for green jobs.

With City, university, and corporate partners at the table, the universities will be able to identify the needs of green businesses in Cincinnati and work to create programs that prepare students to meet

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[77] (California Green Business Program, 2018)

those needs. All members will benefit from the qualified pool of individuals to hire in the region, which will help to grow businesses and institutions.

Partners will work together to make Cincinnati more attractive for prospective students, new and/or low-income residents looking for a job, and businesses looking for a place to settle or grow. This partnership will expand Cincinnati businesses and institutions while keeping the region on the cutting edge of a growing industry.

Examples in Cincinnati and Peer Cities
- Madison, WI
  - The City of Madison is working to create stronger ties with local educational institutions to prepare students for work in the growing field of sustainability. They are working to do this both in the public schools and at the university level.
- Columbus, OH
  - The City of Columbus is working to increase the number of scholarships, internships, and community service opportunities. They are coordinating and marketing speakers, resources for internships, capstone projects, and the Green Business Case Competition.

Who will take the leading role on this project?
- Office of Environment and Sustainability
- Cincinnati Environmental Advisory Council
- University of Cincinnati Environmental Studies Program

Who is the target audience?
- College students
- Young professionals
- Low-income residents
- Unemployed and underemployed residents

What is the City of Cincinnati's role in implementation?
The City of Cincinnati will connect leaders from local business and universities to create training programs for green jobs, and education for sustainability professionals.

Is it feasible?
- Feasibility: Medium
  - There is a strong interest from both the business leaders and the universities to work together to strengthen their partnerships and create stronger networks.
- Obstacles:
  - Some residents are hard to employ because they lack basic job readiness skills
  - It takes close coordination for schools to produce students with the right skills in the right numbers to meet local businesses' hiring needs

How much will it cost?

Cost	Benefit	Cost-Benefit Ratio
$44,500 (To City of Cincinnati)	TBD (To students and workers retraining)	NA

The financially intensive aspect of this jobs training and placement program is the educational part. Cincinnati is lucky to have three large educational institutions whose combined expertise covers most skills which would be requisite in a Green Jobs Training Program. The City could offer a tuition prepay program where the cost of classes is covered upfront and payed back in the form of a loan. Given the propensity of these skills to be in high demand it is likely most of these persons find work and can repay; high (discouraging) interest on loans will not be necessary. At Cincinnati State, the average cost of part time tuition is $148.64 per credit hour. To purchase 6 credit hours for 50 students would cost $44,500.00. The same amount of credits is 6x higher at Xavier, the most expensive school in the City. The City might also consider the creation of a Green Skills/Green Jobs database. Facebook has a method where a client can create a job board and connect it to a Facebook page, the Sustainable Cincinnati Facebook group would be an ideal candidate, due to its membership scale and respective members.

The benefits related to this initiative are numerous; there is enormous market potential to be met. The Bureau of Labor Statistics estimates the value of the Green Construction Industry has increased 14x in the past five years[78]. This is also a fantastic opportunity to enhance Cincinnati's socioeconomic situation; Brooking Institute reports that median earnings in Green Jobs are 13% higher than the average US job; more opportunities for low income, disadvantaged persons to see pay raises by switching fields. The largest sector in green work is related to waste and 84% of green jobs are in metropolitan areas. Brookings also notes Cincinnati's opportunities, given the nature of the City as a logistic hub, they estimated in 2009 Cincinnati exported $550 million in product value related to these fields. They also estimated 75% of Cincinnati green-tech jobs are 'green collar' or related to environmental improvement[79].

Keys to Equity
- A special effort will be made to recruit disadvantaged residents into educational programs and jobs.
- Efforts will focus on both professional and skilled labor occupations.

Timeline for Implementation
- 3-5 years
  - o It will take time to develop new training programs and establish a regular pipeline to employment with local businesses.

Greenhouse Gas Impact

This recommendation will not likely have a direct impact on greenhouse gas emissions in Cincinnati.

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[78] (Liming, 2018)

[79] (Muro, 2016)

6. Create branding and communication strategy for Cincinnati sustainability efforts.

What is it and why is it important to Cincinnati?

Sustainability is a key priority for Cincinnati, which can be seen in the practices of businesses, residents, institutions/organizations, and government. To raise awareness, the City will work with partner organizations to create a brand and communication strategy to represent and promote all Cincinnati sustainability efforts. Creating branding will help engage residents and increase awareness and participation in sustainability programs. Improved sustainability messaging may help bring attention and funding to these initiatives. The brand and messaging must be designed to motivate an economically and racially diverse audience.

Examples in Cincinnati and Peer Cities
- Cleveland, OH
    - Cleveland's Green City on a Blue Lake is an effort to brand the city's sustainability efforts.
    - http://www.gcbl.org/
- Indianapolis, IN
    - Indianapolis is working to promote the brand of their unique Greenway System.

Who will be taking the leading roles on this project?
- Office of Environment and Sustainability
- Cincinnati Environmental Advisory Council
- BluEarth

Who is the target audience?
- Residents
- Communities
- Businesses

What is the City of Cincinnati's role in implementation?

The City will work to create a sustainable brand to be used for all sustainability efforts in the City. The City will also encourage sustainable projects to adopt the branding created to show a unified effort to make Cincinnati a better (and greener) place to live.

Is it feasible?
- Feasibility: Medium
    - The City will create a new brand for sustainability initiatives. It will take time and continued effort to ensure the branding is adopted by sustainability projects around Cincinnati and recognized by residents.
- Obstacles:
    - There are countless sustainability initiatives being pursued throughout Cincinnati with new projects starting up every day. It will require an easy streamlined system of

identification to ensure as many projects as possible are using the Cincinnati sustainability branding.

How much will it cost?

Cost	Benefit	Cost-Benefit Ratio
~$32,000 (To City of Cincinnati)	TBD (To City of Cincinnati)	NA

Creation of a brand will require graphic design expertise and brand coordination. The development of the terminology, imagery and other graphic components are likely one-time costs. The City could pursue an inclusive method for the graphic aspect; a contest among students at local art schools with a small scholarship attached could yield positive results for as little as $500. Should the City hire a branding agency they could expect to spend $15,000-$50,000; this averages to $32,000. A good brand adds value. As the brand becomes more identifiable, brand equity will rise yielding a higher value.[80]

Keys to Equity

For local business, Cincinnati's sustainability branding will help identify them as a company committed to making Cincinnati a better place to live. This branding will attract new customers who are looking to do business with a company that is living up to a commitment to sustainable practices.

Timeline for Implementation
- Expected: 1 - 2 years
  - The creation of branding for the City will not take long, however it will take time to spread awareness and create a system to identify new projects looking to adopt the City's sustainability branding.

Greenhouse Gas Impact

This recommendation will not likely have a direct impact on greenhouse gas emissions in Cincinnati.

7. Identify partners to lobby state government on sustainability issues.

What is it and why is it important to Cincinnati?

The City of Cincinnati has achieved many successes with sustainability efforts in the City, but some efforts require statewide legislation to make the program viable and effective. The City will establish partnerships with local and state organizations who are already lobbying the state government for green legislation. Providing the backing of the City will provide the lobbying organization with a strong partner when advocating to state legislators.

The City will work with cities around the State of Ohio to identify green legislation they can all support. Most Ohio cities are facing similar obstacles and have similar interests in finding a solution that can

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[80] (Silva, 2017)

benefit everyone. For statewide issues, it sends a powerful message when the State's largest cities are all advocating for similar legislation.

For Cincinnati, this recommendation provides an opportunity to push for state legislation that will help the City and will create strong partnerships across the state. With the assistance of state government and partners, the City will be able to implement regional programs that help to make Cincinnati and neighboring communities more sustainable. Working with state government also provides an opportunity to identify and apply for state funding to invest in the City's sustainability efforts. Supporting statewide sustainability efforts is important because as Ohio becomes more sustainable, so will Cincinnati.

Examples in Cincinnati and Peer Cities
- No one is currently doing this

Who will be taking the leading roles on this project?
- Ohio Citizen Action
- Ohio Environmental Council
- American Council for an Energy-Efficient Economy

Who is the target audience?
- State legislators

What is the City of Cincinnati's role in implementation?
- The City of Cincinnati will be responsible for using its resources and connections to connect local partners with legislators at the state level who are willing to promote sustainable initiatives for cities.

Is it feasible?
- Feasibility: Medium
  - Cincinnati maintains a presence at the State Capital which can be used to lobby for sustainable initiatives.
- Obstacles:
  - The current State Legislature may not be responsive to urban concerns. The City must look to other cities around Ohio to assist in pressuring state legislators to focus on the problems in Ohio's urban areas.

How much will it cost?

The cost of lobbying at the state level is likely to be modest. The biggest contribution that City government can make to sustainability lobbying efforts is the expertise, connections and foresight that is unique to City institutions and their employees. The City may find it has a unique ability to push the ball on Sustainability at a higher level than most institutions or persons can do. As such, the City could be a valuable partner to many and could be a valuable source of leverage which could be utilized for Sustainability initiatives now and in the future.

Keys to Equity

Successfully lobbying at the state level will provide a benefit for all residents who can benefit from state laws. The City of Cincinnati will lobby for green legislation that has a special focus on helping the lowest income residents in the State's urban areas.

Timeline for Implementation
- Expected: 1 - 2 years
  - The City already works with the state government and will lobby when they see it necessary. Once efforts are organized around lobbying with a focus on sustainable initiatives, the City will be able to use its existing connections to engage state legislators.

Greenhouse Gas Impact

This recommendation could have major impacts on greenhouse gas emissions in Cincinnati and statewide if lobbying efforts are focused on reducing our state's reliance on coal and other fossil fuels for electricity generation. However, it is not possible to quantify carbon reductions without specific policy for evaluation.

8. Build partnerships with existing business incubators to include sustainability training.

What is it and why is it important to Cincinnati?

Business incubators host clusters of start-up businesses that work together to achieve success. Using a space where the entrepreneurs can interact is important because they can learn from one another and improve each other's businesses. This model strengthens local start-up businesses giving them a strong support system as they get started. Most incubators require participating entrepreneurs to complete a structured training program that teaches the fundamentals of operating a business. The City will partner with local business incubators and green business professionals to provide a training module on sustainability and coaching on green business practices for incubator participants.

Cincinnati already has several organizations who are working to promote entrepreneurial efforts. The City will work with these organizations to support their efforts and encourage entrepreneurs to adopt a green business model when they begin their business. The City will also evaluate its contract system to incorporate green requirements for appropriate City contracts. This will encourage business to adopt green practices and give an edge to those businesses who are already following a green model. The City will seek to work with business incubators that have policies that encourage minority and women entrepreneurs, and the hiring and career development of local and disadvantaged workers.

The City is committed to making Cincinnati a more sustainable city. Coaching new entrepreneurs will build businesses that help the City achieve its green goals. Massachusetts is home to the largest green business incubator in the country with over 50 green businesses sharing large warehouse spaces. Many

of these businesses are clean energy and clean technology companies who are working to cut carbon emissions and fight climate change. Greening Cincinnati's business incubators will increase the green business presence in the City which will strengthen our local economy, provide green jobs to residents, and improve the environment.

Examples in Cincinnati and Peer Cities
- Madison, WI
  - The City of Madison is working to create green job training services to promote the growing green sector. They are doing this by creating programs, working with local businesses to identify their needs, and putting an emphasis on providing green jobs to low income residents.

Who will be taking the leading roles in implementation?
- Office of Environment and Sustainability
- Cincinnati Environmental Advisory Council

Who is the target audience?
- Cincinnati youth
- Unemployed
- Low income residents

What is the City of Cincinnati's role in implementation?

The City of Cincinnati will work with existing business incubators to expand their training to include sustainable business practices. They City will help develop a training program based upon the needs of Cincinnati companies.

Is it Feasible?
- Feasibility: Medium
  - There is a growing need for workers who have training in the field of sustainability and that are literate in the ins and outs of the sustainability industry, meaning employers have a reason to help develop this program
- Obstacles:
  - The City currently does not have a training program for those going into the sustainability industry. The City will need to work with businesses to develop a program based on the specific needs of Cincinnati.

How much would it cost?

Cost	Benefit	Cost Benefit Ratio
$50,000 (To City of Cincinnati)	TBD (To business community)	TBD

The cost to provide sustainability training and coaching at local business incubators is basically the salary for a person who will provide the training and coaching. A study by Goldman Sachs found that stock prices for companies that embraced environmental, social and governance policies rose 25% faster than the market as a whole [1]. Start-up businesses will also grow faster by embracing green policies. The value of the increased growth cannot be quantified at this time.[81]

Keys to Equity

The City will put an emphasis on reaching out to low income communities and offering them opportunities to get involved in training for the sustainability sector. Many of these jobs pay above minimum wage and with the industry continuing to grow, there are increasingly new opportunities around the Greater Cincinnati region.

Timeline for Implementation

- Expected: 1 - 2 years
    - This recommendation relies on the participation of business incubators to achieve success. The City will immediately begin to engage with these businesses to make them aware of the benefits of training local residents for a job within the sustainability field. With their assistance, a job training program can be developed based on the needs of the businesses.

Greenhouse Gas Impact

This recommendation will not likely have a direct impact on greenhouse gas emissions in Cincinnati.

9. Expand environmental education and experiences for CPS students and others.

What is it and why is it important to Cincinnati?

Youth environmental education and experiences are crucial to developing a generation of environmentally conscious citizens. Teaching simple habits such as recycling in Cincinnati Public Schools (CPS) will help kids develop sustainable habits that will stay with them throughout their lives. Environmental education incorporated into the curriculum will help students understand their impact on the environment and why they should care about minimizing their impact. Several CPS schools already have programs such as school gardens that are helping teachers incorporate the environment into curriculum. Environmental education is an interdisciplinary topic that spans all subjects, and can be incorporated into current curriculum. Several non-profits currently provide environmental education to CPS students, but it is not done in a coordinated or consistent way, and is not done at a scale that can reach all CPS students.

CPS has one of the nation's largest concentrations of school facilities built to LEED sustainable design standards. The district has an opportunity to be a national example for incorporating sustainability education into all aspects of the student experience. While the buildings were created to LEED standards, they are not being used as a teaching tool.

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[81] (Eco-officiency, 2017)

CPS and interested non-profit organizations should work together to deliver environmental education to each student each year that fulfills CPS' academic criteria and provides, over time, a well-rounded environmental awareness.

Examples in Cincinnati and Peer Cities

- Keep Cincinnati Beautiful
    - KCB provides programs on recycling and waste minimization to numerous CPS classes each year.
- Dater Montessori Nature Center (FB/Dater Montessori Garden)
    - The nature center is open year-round to all visitors. LEED Gold certification went to the newly renovated school in 2010 with the Land Lab earning certification points. This site and its long time Coordinator and team of volunteers are available for school visits, teacher training and other community members to visit, learn, and enjoy the restored natural areas.
        - (http://dmnaturecenter.wix.com/dater-nature)

Case Study: Rooftop Garden in Rothenberg School

1 Julie Stubbs, Naturalist Great Parks of Hamilton County leading a pollinator program, photo provided by Rothenberg School

The Rothenberg Rooftop School Garden is an outdoor garden classroom that provides opportunity for experiential learning to enhance students' development of critical thinking and 21st Century skills. The garden exposes inner-city children to the natural environment and educates about preservation, conservation, nutrition, healthy eating, and sustainability.

Further Reading: http://www.rothenbergrooftopgarden.com/

Who will be taking the leading roles in implementation?

Who is the target audience?

- Cincinnati Youth

What is the City of Cincinnati's role in implementation?

- The City of Cincinnati will help CPS and interested non-profits to partner for the delivery of environmental education.

Is it feasible?

- Feasibility: Medium
  - There is a strong base of organizational and educational leaders who are already working to develop and implement youth environmental education in the Greater Cincinnati region. The City must bring these leaders together to develop a comprehensive environmental education programs that utilize the wide range of resources available in the city. Having partners like the Cincinnati Zoo will allow a program to be created that involves both classroom and interactive learning experiences.
- Obstacles:
  - Creating a successful environmental education program will require the participation of a wide variety of organizations. Organizing these efforts across multiple schools will require strong leadership and communication.

How much will it cost?

More work is needed to determine how much money is currently being devoted to environmental education for CPS students, and how much would be needed to deliver a comprehensive program for all grades.

Keys to Equity

Implementing environmental education in all CPS schools would help ensure the next generation of Cincinnati residents have a basic understanding of environmental problems and a better understanding of their own impact on the environment.

Timeline for Implementation

- Expected: 1 - 2 years
  - There is a lot of work already being done around youth environmental education. With the participation of CPS officials and organizations already working in this space, environmental education will be incorporated into CPS schools at every level.

Greenhouse Gas Impact

This recommendation will not likely have a direct impact on greenhouse gas emissions in Cincinnati.

ENERGY

Providing power to Cincinnati sustainably and efficiently

The Energy Team was tasked with developing recommendations that go to the heart of our City's focus on reducing greenhouse gas emissions. Energy powers most everything we do as a community, but it also contributes an enormous burden in the form of carbon and related emissions that create negative health outcomes for residents and increasingly disrupt our climate.

Fortunately, energy efficient technologies and renewable energy can now power our lives without these harmful side effects, and many of them are now in cost parity or even less costly than traditional fossil fuel sources. Accelerating this transformation locally offers not only important environmental and health benefits, but can help grow our region's economy and position Cincinnati as a leader in a rapidly growing global industry.

From milestone projects to community programs, we have already established a foundation of success to help propel this transition. Through the City's residential aggregation program, more than 80% of City residents are powering their homes with 100% renewable energy. The City recently contracted for City facilities to achieve the same 100% renewable power goal. Solarize Cincy, a community-based residential solar program, has tripled the number of locally installed solar projects over the last few years. On the commercial side, the PACE energy financing program now allows businesses and nonprofit organizations the ability to upgrade buildings with energy efficiency and renewable energy

infrastructure in a way that can immediately reduce annual expenses. Local corporate leaders are helping to blaze the trail: with a series of large wind and solar projects, P&G has moved to powering all of its North American plants that manufacture home care and fabric products from renewable power; Macy's commitment to rooftop solar power puts it in the top 10 of the U.S. Corporate Solar Champions; Kroger is seeking to reduce electricity use 40% by 2020; Duke Energy met its previous carbon emissions reduction target of 30% and is increasing that goal to 40% reduction by 2030; and Fifth Third Bank recently announced a commitment to move to 100% renewable power across its entire portfolio.

The future holds even more exciting opportunities. Last year, Mayor John Cranley committed the City to powering 100% of its operations from clean, renewable energy by 2035. To move toward this goal, the City plans to develop 25 megawatts (MW) of solar on its property (enough to power 3,000 homes). Once complete, this will be the largest onsite municipal solar array in the country and the largest solar array in Ohio.

The Energy Team enthusiastically supports these bold new ideas and has outlined a series of other opportunities and investments to help achieve the City's larger energy and greenhouse gas goals. In doing so, we have sought solutions that will not only help solve our community's energy challenges, but to confront issues of equity as well. Our diverse group of energy professionals and community leaders believes that in creating solutions that benefit all, we are best able to achieve these ambitious goals.

Jeremy Faust
Energy Task Team Lead
Fifth Third Bank

Goals

1) 100% RENEWABLE ENERGY FOR CITY GOVERNMENT BY 2035.

Path to 100% Renewable Energy
In accordance with Mayor John Cranley's commitment to 100% renewable energy by 2035, the City of Cincinnati has outlined five key steps to accomplishing this goal as well as the interim goal of achieving Carbon Neutrality by 2030.

Key Steps to 100% by 2035:

1. **25 MW solar array:** Installation is scheduled to begin in 2019. The arrays will produce approximately 33 million KWH per year, eliminating 25,000 tons of greenhouse gas emissions annually. (See Energy Recommendation # 4 for more details.)
2. **RECs for City buildings:** The City has signed a contract with Dynegy to power 100% of the City's buildings with carbon-free energy. The City expects to save up to $100,000 annually and reduce greenhouse gas emissions up to 9.1% through this contract. (See Energy Recommendation # 3 for more details).
3. **Off-site power purchase agreement for the remaining electrical load:** Ohio regulations allows the City to select the generation supplier of its electricity. When the City's current electricity

contract expires in December of 2020, the City will investigate contracting the remaining load not met by the solar array to an off-site renewable energy generation facility. To meet the remaining load, the array will need to produce over 260 million KWH of power, eliminating 193,000 metric tons of greenhouse gas emissions annually. (See Energy Recommendation #4 for more details.)

4. **LEED Silver for all City buildings:** All new City Facilities will be LEED Silver or better. An example of this is the District 3 Police headquarters, which is a LEED Platinum and Net Zero Energy facility. The building generates as much energy as it consumes. It is the first net zero police station in the country. Most importantly however, is that it is a functional police station enhancing the officers' ability to do their job. This facility met the LEED standards by incorporating solar panels to produce electricity, geothermal heating and cooling, LED lighting, super-insulating triple pane (and bullet proof) windows, bio-swales for stormwater retention, and many other sustainable elements. The facility uses less than 50% of the average energy required to operate a typical 24/7 public safety building of its size. (See Built Environment Recommendation # 7 for more details.)

5. **Green the Fleet:** Among the nearly 2,500 vehicles operated by the City of Cincinnati there is opportunity to reduce emissions and save money. A $40 million-dollar capital improvement plan is being implemented to modernize the fleet, as much of the fleet is beyond its useful life. Transitioning to electric vehicles and alternative fuels, where applicable, offer the opportunity for reduced emissions, maintenance and fueling costs. (See Transportation Recommendation #3 for additional details.)

6. **Heat Pumps:** Use of air source and ground/geothermal heat pumps can be an extremely energy efficient technology. Heat pumps work efficiently because they transfer heat rather than burn fossil fuels to create it. Ground source heat pumps use the Earth as a source of heat in the winter and as a heat sink in the summer, which drastically decreases energy requirements. The District 3 Police Station and the Anderson Pavilion at Smale Riverfront Park have already made effective use of this technology.

Challenges: The central challenges in transitioning the entire City government off of carbon intensive energy sources are cost and availability of clean technologies. Examples of these challenges include:

1. Availability of cost effective heavy duty electric vehicles. While many of the City's light duty vehicles can be replaced by electric vehicles, other City fleet vehicles -fire trucks, ambulances, snow plows, bucket trucks - are specialized equipment with few if any electric replacement options. Many of these challenges will be addressed as the technology matures. The City expects the costs to drop and availability to increase over time.

2. Cost effectiveness of Renewable Energy Credits for GCWW and MSD: GCWW and MSD manage their energy spend very effectively. They receive transmission level service at a market rate. This results in a very low per kwh charge. Any increase in electricity pricing from purchasing REC's will be directly passed along to the ratepayer. A more cost-effective path forward is obtaining generation directly from renewable sources.

3. Ability to implement heat pump technology in existing buildings: It is most cost effective to install HVAC at the time of construction. The majority of Cincinnati's facilities are already built

and utilize traditional HVAC. While the City will continue to implement heat pumps in new buildings where feasible, to retrofit existing facilities will require significant amounts of capital and will be done over time as existing units reach the end of their useful life.

4. Alternatives to processes used by GCWW and MSD to treat water and wastewater. Both MSD and GCWW utilize large amounts of natural gas in their treatment process. GCWW uses a furnace to regenerate activated charcoal which is used to remove impurities from the raw water. MSD utilizes an incinerator to dispose of biosolids at its Mill Creek treatment facility. Alternatives such as an anaerobic digester for MSD or electrified furnaces for GCWW exist but require significant capital investment.

Current City Renewable Energy Production

City Facility	Type	Megawatts
Parks Administration Headquarters	Solar	0.01035
Ault Residence	Solar	0.006075
Krohn Conservatory	Solar	0.00846
Trailside Nature Center, Burnet Woods	Solar	0.00517
Oak Ridge Lodge Mt. Airy Forest	Solar	0.00484
Fulton Avenue Restroom, Eden Park	Solar	0.00517
Parks Operation Headquarters	Solar	0.01008
Mt. Airy Forest Service Building	Solar	0.01645
Maple Ridge Lodge, Mt. Airy Forest	Solar	0.01645
Facility Maintenance HQ, Eden Park	Solar	0.0282
International Pavilion at Ted Berry International Friendship Park	Solar	0.0141

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LaBoiteaux Nature Center	Solar	0.0141
Ault Park Maintenance Building	Solar	0.00423
Parks Operation Headquarters	Solar	0.0508
Warder Nursery	Solar	0.0038
Smale Riverfront park	Solar	0.02166
Facility Maintenance HQ, Eden Park	Wind	0.005
Findlay Market	Solar	0.02166
Duke Energy Convention Center	Solar	0.10128
College Hill Rec Center	Solar	0.159
One-Stop Permit Center	Solar	0.1006
Beekman Garage	Solar	0.2062
GCWW Richard Miller Treatment Plant	Solar	0.044
GCWW Administration Building	Solar	0.28028
GCWW Richard Miller Treatment Plant	Solar	0.04752
District 3 Police Station	Solar	0.33
GCWW Richard Miller Treatment Plant	Hydro	0.3
Metropolitan Sewer District	Solar	0.03

Total   **1.846475**[82]

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[82] (City of Cincinnati, 2018)

2) TRIPLE RENEWABLE ENERGY GENERATION FOR RESIDENTS AND BUSINESSES.
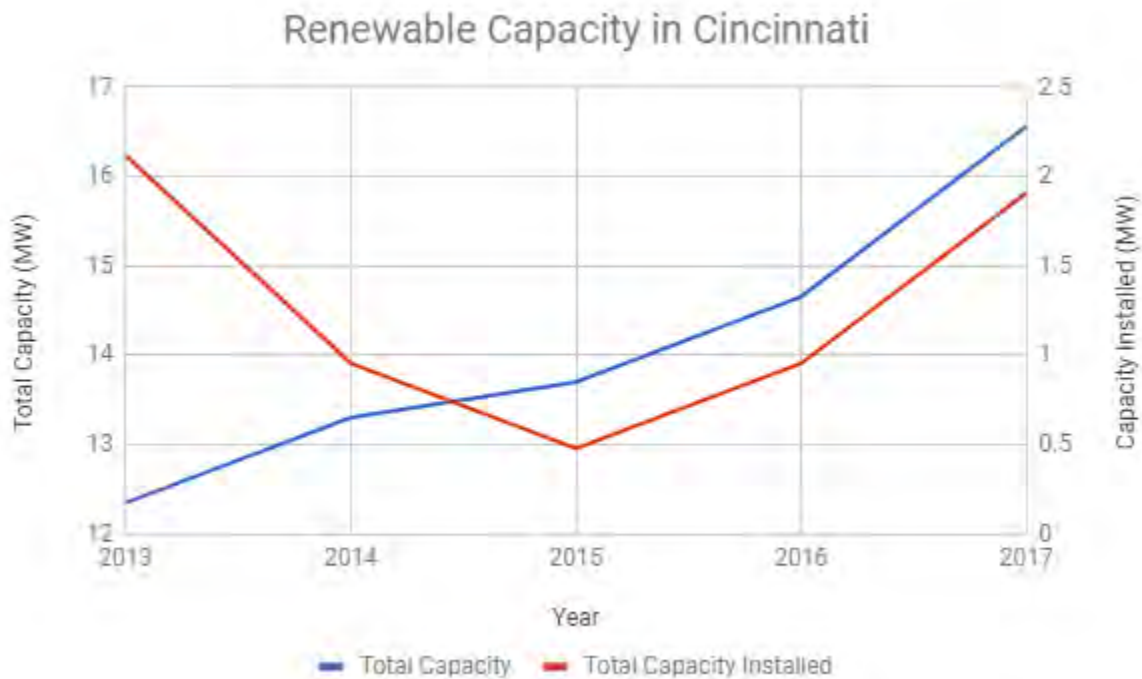
Renewable energy in Cincinnati currently includes solar, wind, and hydropower. Renewable energy that came online in a given year is considered capacity installed that year. 2016 and 2017 data are projected values. Citation: Green Umbrella, 2017

3) REDUCE ENERGY CONSUMPTION 2% ANNUALLY.

To continue progress toward more efficient use of energy, a 2% annual reduction in energy consumption. The two percent goal would include total energy consumption from the residential, commercial, and industrial sectors.

Cincinnati's Electricity and Gas Consumption by Sector
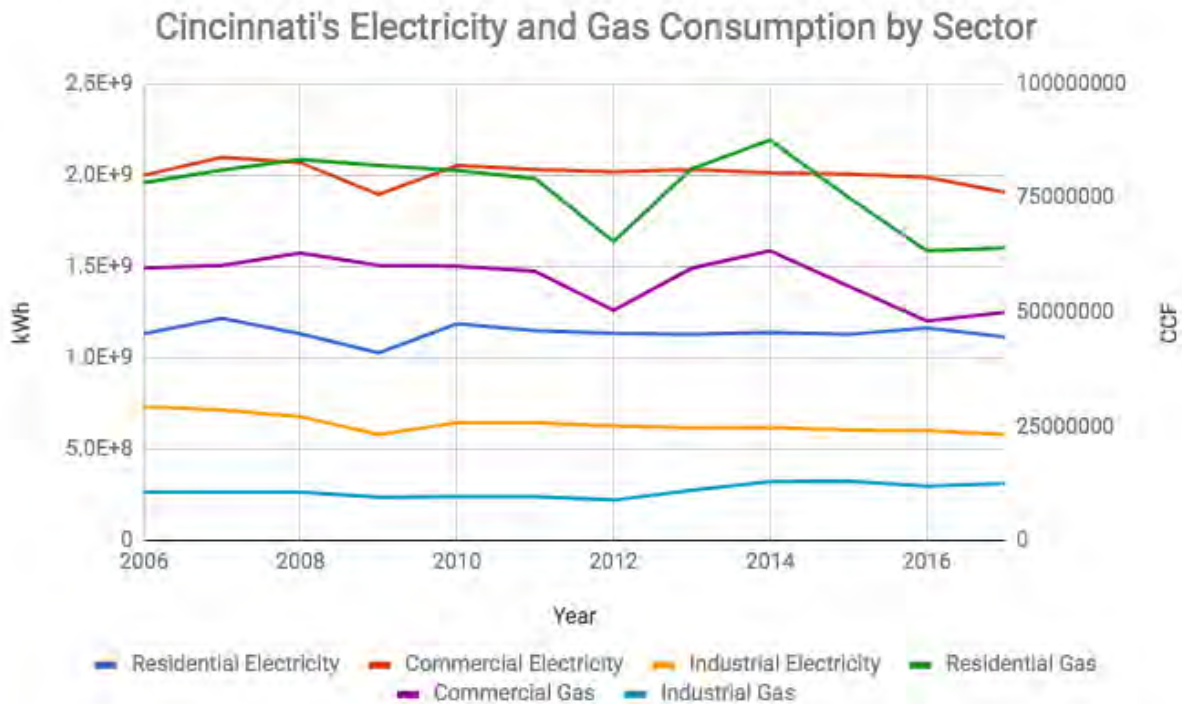
Energy consumption for industrial, commercial, and residential accounts within the zip codes of Cincinnati were provided by Duke Energy. Zip codes straddling the border of the City of Cincinnati were classified as inside or outside the City based on a 2006 evaluation of population density within the zip code. Citation: 2015 Cincinnati Greenhouse Gas Inventory and Analysis, City of Cincinnati Office of Environmental and Sustainability, 2015.

Recommendations

Many of the recommendations of this plan are inter-related, and have multiple benefits. For additional recommendations related to Energy, please see:

- *Built Environment #3: Improve City Facilities by investing in energy efficiency—specifically HVAC and lighting.*
- *Built Environment #6: Target multi-family properties for energy efficiency improvements.*
- *Education & Outreach #1: Install solar panels on Cincinnati Public Schools facilities.*
- *Resilience #7: implement renewable power backup systems for areas of refuge and emergency facilities (911 center, recreation centers, hospitals).*
- *Transportation #2: Encourage the use of electric vehicles through City programs that incentivize electric vehicle ownership and infrastructure.*

1. Increase outreach to and participation of industrial customers in renewable energy and energy efficiency projects.

What is it and why is it important to Cincinnati?

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The City of Cincinnati will work with outside organizations to support a campaign that targets the industrial sector to reduce energy consumption and provide energy efficiency solutions. The campaign will promote adoption of the energy efficiency strategies that are used by other industrial facilities. Increasing the energy efficiency of the industrial sector is important to reducing the overall energy burden that is placed on the grid. Educating operators of industrial buildings about energy efficiency projects and renewable energy options will relieve stress on the grid which will benefit all residents in terms of fewer blackouts and lower rates. In order to reach as many industrial facilities as possible, the campaign will educate a wide variety of customers so that all have the tools to reduce usage.

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Case Study: The Greenest Zoo in America

The Greenest Zoo in America has been a leader not just in the region but nationally in pioneering implementation of renewable energy and energy efficiency. They have taken initiative to generate renewable electricity including a 1.2KW turbine installed in the Go Green Garden Exhibit which can produce 2000 KWH annually, working with a 10KW solar array, covering one-third of the Membership and Ticketing Building's demand. A 20KW solar array sits atop the roof of the Harold C. Schott Education Center, providing up to 25 percent of the energy needs to operate the building. The Zoo installed a 1.56-megawatt array with 6,400 panels on a canopy structure over the Vine Street Parking Lot, protecting the lot from hail and day heat. This solar array is the largest, urban, publicly accessible array in the nation. 36 geothermal wells use heat transfer to contribute significantly to the heating and cooling of the buildings located in Historic Vine Street Village. The Zoo is not done yet; they are currently exploring biomass generation, including a small scale anaerobic digester to generate energy from elephant waste. The train and portions of their vehicle fleet use biodiesel. Switching incandescent lights to LED lights for the annual Festival of Lights, has helped to reduce energy usage by 75 percent. In total, two LEED Platinum, four LEED Gold buildings, and two LEED silver buildings are located on the campus. While the Zoo has expanded building square footage by 25% in the past 7 years, they have managed to reduce energy consumption by 11 percent, saving over $1.5 million and reducing greenhouse gas emissions.

Examples in Cincinnati and peer cities
- Cleveland, OH

- ○ Cleveland area labor unions are training workers to make industry more energy efficient.
  - ○ http://midwestenergynews.com/2017/08/30/ohio-shines-spotlight-on-energy-efficiency/
- ● Minneapolis, MN
  - ○ Minneapolis has set a goal to increase energy efficiency in commercial/industrial buildings by 15 percent and will do this through programs such as providing loans for industrial facilities to complete energy efficiency projects.
  - ○ http://news.minneapolismn.gov/2017/10/27/city-recognize-large-commercial-buildings-energy-efficiency/

Who will be taking the leading roles on this project? (Potential)

Who is the target audience?
- ● Industrial companies and their facility operators

What is the City of Cincinnati's role in implementation?
- ● The city will provide support to outside organizations that will be taking the lead on this recommendation.

Is it Feasible?
- ● It is very feasible because other peer cities have already implemented similar projects.

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio
TBD	$2 million/year	TBD

Costs of the outreach program are to be determined. A 1% per year reduction in electricity and natural gas usage by the industrial sector in Cincinnati would reduce utility bills by approximately $2 million/year

Keys to Equity?
- ● Target all industrial buildings, especially those located in disadvantaged areas where people are disproportionately affected by the pollution created from these facilities
- ● Provide a funding source so that all facilities can upgrade even if they need financial assistance.
- ● Educate both residents and facility on why it is important to increase energy efficiency.

Timeline for Implementation

● This recommendation will take 2 to 4 years to implement.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2030	2050
16,910 mtCO$_2$e	98,956 mtCO$_2$e	207,112 mtCO$_2$e	477,316 mtCO$_2$e

Energy usage by industrial facilities will be reduced 1% per year. This target is consistent with the rate of decline achieved from 2006-2015. The industrial sector in Cincinnati used 9,000,000 kWh of electricity and 178 million therms of natural gas in 2015.

2. Expand programs to increase energy efficiency and solar energy generation for the private market (e.g. Solarize, PACE financing).

What is it and why is it important to Cincinnati?

The City of Cincinnati will enhance its energy efficiency and solar programs offered to residents and businesses. Increasing education and providing social proof for potential customers is crucial to increasing efficiency and the number of solar installations. The City is currently working with the Greater Cincinnati Energy Alliance to offer three programs:

1. Solarize Cincinnati is a marketing and outreach campaign where the City and Greater Cincinnati Energy Alliance work with residents to participate in a bulk buying program to reduce the costs of residential solar installations.
2. The Get Efficient Campaign enables residents to get an online assessment of their homes and work with the Greater Cincinnati Energy Alliance to select technologies and contractors to make their home more efficient.
3. Ohio PACE is a program that offers businesses and nonprofit organizations the opportunity to secure long-term, off-balance-sheet financing for the installation of renewable energy and energy efficient building improvements.

All programs presently require the resident or building owner to pay or qualify for financing to receive the benefits of the program. This model limits accessibility and scalability of the programs. The City will work with Greater Cincinnati Energy Alliance and other community stakeholders to grow participation in these programs for people of all incomes, including non-profit organizations.

Increasing efficiency and solar usage will have climate, resilience, and financial benefits. Both energy efficiency and solar panels reduce the amount of fossil fuel energy consumed by a home. The average home consumes 1,000 kilowatt hours (kWh) per month. Reducing the overall amount of energy consumed is one of the most cost effective and accessible ways to shrink a home's carbon footprint. For many homes in Cincinnati, most of the electricity use could be generated from solar. In addition, when paired with battery storage, should the grid power fail, basic functions will be able to continue in buildings until power can be restored by the utility. Finally, the increase of solar power will reduce stress

on the grid during times of peak consumption. Typically, peak demand occurs during hot and sunny summer days when solar produces the highest amount of electricity.

Examples in Cincinnati and peer cities.
- Solarize Cincinnati
    - A program implemented by the Office of Environment and Sustainability to buy solar in bulk to reduce costs for residents who want to install solar panels.
    - https://greatercea.org/residential/solarize-cincinnati/
- Get Efficient
    - A program to assist homeowners in navigating the decision process and contractor selection when choosing to improve efficiency in their homes.
    - https://getefficient.energysavvy.com/residential/start/
- PACE Financing
    - Financing method that incentivizes commercial properties to invest in energy-efficiency improvements.
    - https://greatercea.org/pace-financing/

Who will be taking the leading roles on this project?
- Office of Environment and Sustainability

Who is the target audience?
- Businesses and non-profit organizations
- Residents
- Low Income Residents

What is the City of Cincinnati's role in implementation?
- The City will be a member of a larger team that spearheads this recommendation. To implement this recommendation, the City will continue to market programs such as Solarize and work with partners to implement programs that peer cities have used. It will be a priority to modify the programs to make them more accessible for low income residents.

Is it Feasible?
- Feasibility: Easy
    - Cincinnati already has programs that have worked in the past and will be revamped to reach more diverse populations in the city.

How much would it cost?

	Cost	Benefit	Cost Benefit Ratio
Solarize (6KW)	$11,000 (to homeowner)	$850/yr. (to homeowner)	13-year payback
Get	$4,000 (to homeowner)	$800/yr. (to homeowner)	5-year payback

Efficient			
PACE	$1,200,000 (to property owner)	$120,000 (to property owner)	10 years

Figures are based on a typical project in each program.

For Solarize:
- There are four tiers of pricing based on the size of the installation. Prices per KW are lower for larger systems.
- A federal tax credit currently exists for 30% of the installed cost of solar. That credit begins to be reduced in 2019 and is eliminated entirely for residential structures in 2022
- The City will continue to use and improve marketing materials that will have a minimal cost

Further Reading: Greater Cincinnati Energy Alliance, https://greatercea.org

Keys to Equity?
- Target low-income residents who spend large portions of their income on utilities
- Provide incentives or financing for disadvantaged residents to participate
- Campaign and market in diverse neighborhoods
- Educate all residents on the benefits of solar and other energy improvement upgrades
- Target private buildings that have low-income tenants to provide PACE financing for energy improvements

Timeline for Implementation
- It is anticipated that 70 Solarize projects, 70 Get Efficient projects, and 1 PACE project will be completed in 2018, with increased uptake for both programs in subsequent years.

Greenhouse Gas Impact

Annual Emissions Reduction Potential

	2018	**2023**	**2050**
Solarize	392 $mtCO_2e$	975 $mtCO_2e$	134,000 $mtCO_2e$
Get Efficient	280 $mtCO_2e$	695 $mtCO_2e$	95,000 $mtCO_2e$
PACE	1600 $mtCO_2e$	16,000 $mtCO_2e$	160,000 $mtCO_2e$

We estimate 70 Solarize and Get Efficient installations in year 1, and 20% annual growth.

We estimate 2 PACE projects in year 1, 20 by the end of year 5, and 200 by 2050.

3. Increase renewable energy generation for use by City Government.

The City of Cincinnati will enhance its use of renewable energy at all City facilities where renewable energy can meet or beat the grid cost of electricity. By utilizing all available subsidies and financial tools, the City will expand solar installations on City facilities and enter into off site renewable energy contracts to supply electricity for City accounts. These installations will enable the City to reduce electricity costs when compared to the cost of grid electricity.

Additional benefits beyond carbon reduction and below grid-cost electricity exist for the installation of onsite solar at City Facilities. When paired with battery storage, solar can provide backup power during times of power outages improving the resiliency of City facilities.

The City's path to 100% renewable is envisioned to include 3 initial phases:
1. Phase 1: Installation of 1.8 MW of renewable generation on City Facilities (Completed);
2. Phase 2: Installation of 25 MW on City property, including Lunken Airport, Water Works, and other city-owned land;
3. Phase 3: Contract to purchase 25+ MW of renewable energy with an offsite power purchase agreement.

Examples in Cincinnati and peer cities
- **Cincinnati, OH**
  - The City is working to build a 25 MW solar array to supplement 1.8 MW of solar already installed on 27 City facilities
- **Fifth Third Bank is the first Fortune 500 company to be 100% solar**
  - https://www.bizjournals.com/cincinnati/news/2018/03/07/fifth-third-to-be-first-to-achieve-100-percent.html
- **Portland, OR**
  - Portland has fitted their aquatic center and community center with solar to reduce the stress on their grid.
  - https://www.portlandoregon.gov/bps/article/431300

Who will be taking the leading roles on this project?
- The Office of Environment and Sustainability

Who is the target audience?
- City facilities

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What is the City of Cincinnati's role in implementation?
- The City will be the lead in implementing both initiatives. For the solar effort, the City will partner with an experienced developer that will manage and own the project. The tax equity and depreciation benefits of third party ownership will reduce the overall cost of the project. Lessons learned in the solar deal will be applied in the 2nd phase securing an offsite power purchase agreement from renewable sources.

Is it Feasible?
- Feasibility: Medium
- Obstacles:
  - Determinants of success include price of renewable electricity compared to the standard grid price of electricity. Initial studies show this to be economical, but further research and construction bids are needed to truly determine the cost effectiveness of this project.

How much would it cost?

Phase 2:

Installation Costs for 25 MW of Solar	Benefit of electricity produced @.05 per kWh	Cost Benefit Ratio
$40-45 million without incentives (To Developer)	$1.65 million/year [FM1] (To City of Cincinnati)	Will depend on the structure of the deal and incentives

The City is currently working to construct a 25 MW system on 125-150 acres of City owned property. It will reduce the City fossil fuel consumption by 20% and produce 33 million kWh of electricity per year. This gives the energy generated by the solar panels a value of $1.65 million per year. A 25-MW solar project is anticipated to cost $40-$45 million dollars before federal incentives are applied. Financing for the 25-MW solar installations may be accomplished through a variety of financing options or ownership structures. If owned by a private entity, the solar array will be eligible for a 30% federal tax credit and other tax benefits, substantially reducing the price. This contractual relationship may be structured many ways and will be thoroughly reviewed and vetted by the City.[83]

Phase 3:

Installation costs for 25 MW of wind	Benefit of electricity produced @.04 per kWh	Cost Benefit Ratio

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[83] DSIRE (Database of State Incentives for Renewables & Efficiency). 2016. Accessed 8/31. http://www.dsireusa.org/

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38-42 million -without tax incentives* (To Developer)	$3 million/year[FM2] (To City of Cincinnati)	Will depend on the structure of the deal and incentives

25 MW of wind energy would represent an additional 30% of the City Government energy consumption. Should pricing be competitive with grid electricity the City may select to purchase the remaining 50% of its load securing an additional 50 MW of wind power. This contractual relationship may be structured many ways and will be thoroughly reviewed and vetted by the City.

*The cost of installation for 25 MW of wind energy shown above does not include the production tax credit as that is applied to the production of energy not on the installation costs as is with solar.

Keys to Equity
- Place solar in areas not previously exposed to renewable energy allowing all of Cincinnati to see and experience that solar is real and works.
- Educate residents on benefits of solar on City facilities.

Timeline for Implementation
- This recommendation will take 2 to 3 years to implement for phase 1 and an additional 2-3 years for phase 2. Private partners will need to secure financing and to monetize available incentives.

Greenhouse Gas Impact

Annual Carbon Reduction Potential Phase 2 and 3

2018	2023	2030
0	81,500 mtCO$_2$e	81,500 mtCO$_2$e

The 25 MW solar array will not be completed in 2018. When completed in 2019-2020, the arrays will abate approximately 24,500 mtCO$_2$e annually. 25 MW of wind energy will abate approximately 57,000 mtCO$_2$e. Purchasing the entire City's load from renewable energy sources would result in annual reduction of 223,000 mtCO$_2$e.

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4. Improve access to financing for energy efficiency and renewable energy, especially for low income households.

What is it and why is it important to Cincinnati?

The City of Cincinnati will work with outside organizations to improve access to energy efficiency and renewable energy upgrades with a specific target on low income/moderate income households. Targeting low income households will allow them to reduce their energy costs by simple and effective methods while lowering the upfront cost of these improvements.

Reaching low income residents and addressing the financial barriers to entry is a significant challenge for energy efficiency and renewable energy projects. To address this challenge, financing will be coupled with an educational campaign that stresses the importance of energy efficiency in a household. By providing low-cost, low maintenance options such as energy efficient appliances, LED light bulbs, and smart thermostats, residents can take advantage of significant cost savings. Implementing renewable energy options will provide residents with a lower utility bill and free energy once the upfront costs are paid off. Financing options reduce or eliminate the upfront investment so it is not a financial burden for low income households to become more energy efficient.

Energy efficiency is a tool to put money in people's pockets and low-income communities have been historically unable to participate. There are many organizations in Cincinnati that are working to address this problem. A conscious, coordinated effort is required to leverage resources, attract new resources and to make significant inroads.

Examples in Cincinnati and peer cities
- **Madison, WI**
  - Madison is working to provide financing for sustainable building and retrofits to promote more green buildings in the city
  - https://www.cityofmadison.com/sustainability/documents/SustainPlan2011.pdf
- **Boston, MA**
  - Boston has expanded on their financing system and targeted neighborhoods with low participation and with potentially higher rewards if they invest in energy upgrades
  - https://www.cityofboston.gov/eeos/pdfs/Greenovate%20Boston%202014%20CAP%20Update_Full.pdf

Who will be taking the leading roles on this project?
- Office of Environment and Sustainability

Who is the target audience?
- Low income residents
- Financing organizations

What is the City of Cincinnati's role in implementation?
- The City will provide assistance to outside organizations that set up a financing mechanism that makes energy efficient upgrades more realistic for low income residents

Is it Feasible?
● Feasibility: Moderate
   ○ Peer cities have implemented programs and Cincinnati has already worked to lower the cost of certain sustainable technologies for the public
   ○ Many energy efficiency programs that should be economic no-brainers struggle to enroll residents.

How much would it cost?

Costs	Benefits	Cost-Benefit Ratio
TBD	TBD	TBD

Keys to Equity:
● Target all low-income neighborhoods
● Provide financing with education to make it an easier decision for residents
● Hold workshops and classes for residents to ask questions

Timeline for Implementation
● This recommendation will take 2 to 4 years to implement. First steps include identifying neighborhoods to provide educational materials to along with identifying organizations that will help provide financial assistance to low income residents

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2030	2050
0 mtCO$_2$e	7,500 mtCO$_2$e	45,000 mtCO$_2$e	75,000 mtCO$_2$e

We estimate a targeted outreach program would encourage 5% of 60,000 rental units to invest in improvements by 2023, 30% of units by 2030, and 50% by 2050. We estimate the improvements would yield a 25% decrease in energy consumption annually. We estimate average household electricity consumption is 3,000 KWH per year, equal to 2.5 mtCO$_2$e per household per year.

5. Implement mandatory energy benchmarking ordinance.

What is it and why is it important to Cincinnati?

Measuring building energy performance is an important component in achieving a more efficient building stock throughout Cincinnati. Only by understanding how a building performs can owners and operators make fully informed decisions about needed improvements and energy reduction opportunities.

Energy benchmarking is the process of measuring a building's energy use and comparing it to the performance of similar buildings. This process can be easily and quickly completed using free online tools like the U.S. Environmental Protection Agency's ENERGY STAR® Portfolio Manager tool. The result is an easy to interpret (1-100) score that highlights the relative efficiency of a given building compared to others of a similar size, geography, and use. The process involves entering basic building energy consumption information (energy usage) and identifying general building characteristics like building size, location, and function. The tool is free and easy to use.

Understanding energy performance is not only important for building owners, but is a valuable tool for prospective building owners and tenants in the selection of higher performing buildings. Despite the costs associated with building operations, prospective owners and occupants often have little visibility into how a building performs. In addition, building performance data allows government leaders to make smarter decisions about local energy and building policy.

Leading municipalities throughout the U.S., including Chicago, New York, Denver, St. Louis, Minneapolis, Kansas City, Pittsburgh, New York, Boston, and Atlanta, have adopted city policies that require large buildings to be benchmarked to assess the performance of the building stock. In most of the 26 jurisdictions, this information must be publicly reported to encourage transparency.

More informed building owners make better decisions. By encouraging benchmarking, building owners are more likely to make energy saving investments in their building stock. These investments help generate important local investment and job growth. A study completed on the Philadelphia market found that more than 77% of buildings require energy efficiency upgrades, which could generate more than $600 million in investment and support 23,000 local jobs.

According to the Institute for Market Transformation, benchmarked buildings reduce energy consumption by an average of 2.4% annually. For a 500,000-square-foot office building, this could result in cumulative energy cost savings of more than $100,000. In a recent study, more than half agreed that benchmarking leads to more comprehensive energy efficiency measures.

Market forces push building owners to prefer more efficient buildings, and motivate tenants to choose a building with lower utility costs. Unfortunately, these market forces are impeded because prospective building owners and tenants lack access to vital energy information about buildings. To address these issues, the City will implement a building benchmarking and disclosure program to assure that building owners and tenants have the information needed to properly value energy efficient buildings.

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Similar tools exist for rental properties. One such tool, Rent Rocket, assists residential tenants who are looking for an apartment that keeps energy costs low. Rent Rocket makes a building's utility costs, access to alternative modes of transportation, and ability to recycle visible to prospective tenants. The program allows residents to pick apartments and homes based on sustainable features that appear on the same website where tenants find rental listings. This also puts Landlords in a position to market the sustainable features both in and around their properties.

Increasing energy efficiency on both the commercial and residential sides will provide lower total costs for the owners. Decreasing stress that is put on the grid will provide lower rates, more power when power is needed, and lessen the chance of brownouts and blackouts. Improvements in energy performance make buildings look more attractive to tenants who want to rent and workers who are looking to work for sustainable companies.

Examples in Cincinnati and peer cities:
- **Numerous cities have energy benchmarking and transparency policies.**
  - Institute for Market Transformation maintains a map: http://www.imt.org/uploads/resources/files/IMT_benchmarkingmap_9.2017_final.jpg
- **Pittsburgh, PA**
  - Pittsburgh's energy benchmarking ordinance requires any non-residential building over 50,000 square feet to report energy and water consumption.
  - http://pittsburghpa.gov/dcp/programs/building-benchmarking/comply.html
- **Indianapolis, IN**
  - Indianapolis benchmarks their energy usage for over 50 buildings throughout the city which includes their 730,000-square foot county building
  - https://database.aceee.org/city/indianapolis-in
- **Nashville, TN**
  - Nashville has 46% of its city facilities benchmarked and does this after every retrofit which usually includes HVAC and LED lighting upgrades
  - **https://database.aceee.org/city/nashville-tn**
- **St. Louis, MO**
  - St. Louis' Building Energy Awareness Ordinance requires all city owned buildings and privately-owned buildings over 50,000 square feet to track and report annual energy use using the ENERGY STAR Portfolio Manager tool.
  - www.stlouis-mo.gov/sustainability/
- **Kansas City, MO**
  - Kansas City's Energy Empowerment Ordinance requires city owned buildings greater than 10,000 square feet and commercial and multifamily residential buildings greater than 50,000 square feet to report annual energy consumption through ENERGY STAR Portfolio Manager
  - http://kcmo.gov/kcgreen/benchmarking/.
- **Several cities are displaying data on public visualization sites:**
  - Seattle: www.seattle.gov/energybenchmarkingmap/
  - Philadelphia: visualization.phillybuildingbenchmarking.com/#!/

Who will be taking the leading roles on this project?
- Office of Environment and Sustainability

Who is the target audience?
- Large building owners, including:
  - City Facilities
  - Rental Properties
  - Commercial Properties
  - Building Operators

What is the City of Cincinnati's role in implementation?
- The City of Cincinnati will partner with building management organizations and energy organizations to establish a new benchmarking program and address existing roadblocks to building performance and transparency.

Is it Feasible?
- Feasibility: Medium
  - Over two dozen U.S. cities have successfully implemented building energy benchmarking and transparency policies over the last ten years, including cities of comparable size in our region.
  - Owners of poorly performing buildings may resist a requirement that exposes poor performance.

How much would it cost?

Cost	Benefit	Cost Benefit Ratio
$80,000 (To City of Cincinnati)	Energy savings of 3-8% annually (To renters)	TBD

- Implementing rent rocket is a no-cost service.
- Cities that implement benchmarking requirements devote at least 1 full staff position to implementing and enforcing the program.
- Costs and Benefits of energy improvements in buildings will vary from building to building, but tend to fall within an expected range.
- Benchmarking is also about transparency, including information about the energy performance of rental housing that can impact market rate and low-income tenants alike. By making this information public, tenants can become their own energy advocates and more easily identify lower cost housing opportunities.

Keys to Equity:
- Target rental property owners who rent to low-income individuals
- Benchmark in buildings that serve disadvantaged residents
- Educate residents on Rent Rocket and how it can save them money

Timeline for Implementation
- This recommendation will take 1 year to adopt benchmarking requirements and 1 to 2 years to collect data and display data. Improvements to buildings will occur in 3-5 years.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
0 mtCO$_2$e	55,800 mtCO$_2$e	70,600 mtCO$_2$e

An evaluation of benchmarking and transparency programs in the US reported annual energy savings of 3-8% for participating buildings over a 2-4-year period. A benchmarking ordinance in Pittsburgh requiring buildings >50,000 square feet to report energy consumption engaged 861 buildings totaling 164,000,000 square feet. We estimate similar engagement in Cincinnati. Portfolio Manager reports average carbon emissions of a commercial building in the US of 15 to 20 pounds C02 per square foot. To estimate Cincinnati's carbon reduction potential, we estimate 15 pounds CO$_2$ per square foot, and 5% efficiency improvements every 4 years. [84]

6. Purchase renewable energy credits (RECs) for City operations.

What is it and why is it important to Cincinnati?

The City of Cincinnati will purchase more Renewable Energy Certificates for City operations. Renewable Energy Certificates (RECs) document ownership of the environmental benefits from wind, solar, or other renewable sources. Each REC represents one megawatt hour of renewable electricity delivered to the grid. The REC may be purchased to offset electricity generated from traditional fossil fuel. The RECs assign the benefits of renewable energy without the costs and maintenance of owning solar panels or wind turbines.

The City will purchase RECs to offset some of the energy currently bought from the grid. This saves money in the short term because RECs are less expensive than building renewable generation, however, the REC is a one-time transaction while generation assets would produce for many years. The City will reduce its overall carbon emissions by purchasing renewably sourced energy. This will contribute to the City meeting its goal of 80% reduction of greenhouse gas emissions by 2050.

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[84] (Energy Star, 2017)

By purchasing RECs, the City will be a role model throughout the community and will inspire the private sector to buy offsets for residential and commercial properties. The City will be able to reduce carbon emissions while paying only slightly more for their energy, something that residents who are environmentally-conscious can do as well with their own utility bill.

Examples in Cincinnati and peer cities.
- Cincinnati, OH
  - Cincinnati's Energy Aggregation Program purchase 100% renewable energy credits for residents who participate in the program. Participants receive green energy at a cost that is less than non-renewable sources.
  - https://www.cincinnati-oh.gov/oes/residential-programs/aggregation-program/

Who will be taking the leading roles on this project?
- Office of Environment and Sustainability

Who is the target audience?
- City Facilities

What is the City of Cincinnati's role in implementation?

The City of Cincinnati will contract for REC-backed green energy.

Is it Feasible?

- Feasibility: Easy
  - At the time of completion of the plan the City has already contracted for REC-backed green energy for many City facilities.

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio
$.50 per MWH (To City of Cincinnati)	RECs do not provide a financial benefit.	

The City of Cincinnati recently reached a deal with Dynegy, a local supplier to provide 100% green energy, for almost all City facilities, beginning January 2018. The facilities excluded MSD and GCWW who purchase their energy separately at highly discounted rates. but the Dynegy contract may be impacted by the new Solar Array (see Energy recommendation 4). This deal is expected to save $100,000 annually compared to 2017 electricity rates due to a change in the market rate of electricity.

Keys to Equity

- Informing residents of the program

Timeline for Implementation

- 1-3 years

Greenhouse Gas Reduction Potential

2018	2023	2050
25,325 mtCO$_2$e	25,325 mtCO$_2$e	25,325 mtCO$_2$e

The purchase of renewable energy credits to offset City facilities (excluding Water Works and Metropolitan Sewer District) would yield a GHG reduction of 25,325 mtCO$_2$e annually, a 9% reduction in City government's carbon footprint. If RECs were used to offset all City electricity consumed it would yield a GHG reduction of 220,000 mtCO$_2$e annually.

7. 100% LED Streetlights.

What is it and why is it important to Cincinnati?

The City of Cincinnati will change all its streetlights to LEDs. Changing lights to LEDs will cut the operation costs, reduce maintenance costs, and reduce energy consumption. LEDs last much longer than conventional lamps so they save money on replacement lamps. They also require minimal maintenance which is another avoided cost.

The City of Cincinnati has approximately 29,000 streetlights, including: about 4,000 that are owned by the City and for which the City pays the electricity; 21,000 that are owned by Duke, for which the City pays the electricity; and 4,000 that are owned by the City and for which a third party pays the electric bills. The 4,000 owned and paid by the City have already been converted to LEDs. The remaining 25,000 lights will be converted through collaborations with Duke Energy and third-party bill-payers.

LED streetlights provide more light and better-quality light than conventional streetlights which will help prevent crime in areas that are currently poorly lit.

Examples in Cincinnati and peer cities
- **University of Cincinnati**
  - o UC has implemented 300 LED lights on their campus to improve security, reduce energy usage, and reducing operation costs
  - o http://www.uc.edu/news/nr.aspx?id=22405
- **Portland, OR**
  - o Portland changed over 20,000 street lights throughout the city to save over $1.5 million per year while changing the lights once every 4 years
  - o https://www.portlandoregon.gov/transportation/66147

Who will be taking the leading roles on this project?
- Office of Environment and Sustainability
- Duke Energy
- Department of Transportation and Engineering

Who is the target audience?
- Duke Energy
- Department of Transportation and Engineering
- Entities that pay assessed streetlight bills

What is the City of Cincinnati's role in implementation?
- The City will own this recommendation through the Department of Transportation and Engineering and manage contracts for streetlight retrofits.

Is it Feasible?
- Feasibility: Moderate
  - Approximately 20% of the City's streetlights are LED at the start of FY 2018
  - Previous discussion of LED conversion with Duke Energy have required significant investment from the City of Cincinnati

How much would it cost?

Cost initial	Benefit 5 year	Cost-Benefit Ratio
$14.8 million (To City of Cincinnati)	$3,581,855 (To City of Cincinnati)	1:2.1

Los Angeles recently undertook a similar initiative and had enormous success. Over the course of their implementation the price of LED lighting dropped dramatically. In Los Angeles, initial cost of LED street light fixtures was around $700, and by 2012, the cost of LED street light fixtures was $245. In Los Angeles today, cost of LED light fixtures when bought in bulk can be as low as $150. LA Council District 5 has a population of roughly 260,000 residents, marginally less than Cincinnati. They recently installed 11,600 LED fixtures. At a cost of $150 per fixture this would cost $1.7 million. This district alone found energy savings of 67.4% (8.104GWh, annually) which equates to $716,371[85]. Expressed over five years, at present value, we can expect savings of $3.58 million.

Keys to Equity:
- Focus on areas with higher crime rates
- Implement in poorly lit areas
- Hire disadvantaged residents to perform the replacements.

Timeline for Implementation

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[85] (City of Los Angeles, 2017)

● This recommendation can be implemented over 4 to 5 years.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2030
0 mtCO$_2$e	11,537 mtCO$_2$e	11,537 mtCO$_2$e

In 2015, Cincinnati's streetlight operation emitted 19,228 mtCO$_2$e. The City has 20,000 streetlights that are not yet using LED bulbs. Conversion of streetlights to LED in other cities has produced energy savings of 50-70%. We assume 60% energy savings with conversion to LED. [86]

8. Increase battery storage capacity

What is it and why is it important to Cincinnati?

The City of Cincinnati will work to develop battery storage capacity at the City's critical facilities. Critical facilities include those ensuring public safety such as police and fire stations, and City utilities such as the Metropolitan Sewer District and the Greater Cincinnati Water Works. This may also include City facilities that serve as emergency shelters. Battery storage will allow these facilities to operate and provide key services to residents should the utility grid go down.

Essential services need to be reliable. They need to have enough power to execute their functions. Emergency shelters need power so that they can handle the residents that need their services.

To advance equity, the City will prioritize battery installations in disadvantaged neighborhoods where residents are more likely to need assistance in an emergency. Climate change is bringing more extreme weather. Low income residents are often disproportionately impacted. For example, battery storage could be used at facilities that serve as cooling centers during heat emergencies. Facilities with batteries will be able to reduce their energy costs by pulling from the batteries during peak demand periods.

Examples in Cincinnati and peer cities.
  ● **Charlotte, NC**
    o Duke Energy has a large solar project that allows solar energy to be stored in two large batteries in two locations within the city.
    o http://www.energystorageexchange.org/projects/325

Who will be taking the leading roles on this project?
  ● Office of Environment and Sustainability,

Who is the target audience?

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[86] (The Climate Group, 2015)

● City Facilities

What is the City of Cincinnati's role in implementation?
● The City will own this recommendation and work to identify facilities that have the potential to house solar panels and batteries for storage

Is it Feasible?
● Feasibility: Medium
    ○ Peer cities have implemented similar technologies. Cincinnati has solar panels on City facilities so a system to store excess energy would need to be installed

How much would it cost?

Cost	Benefit NPV 20 Years	Cost-Benefit Ratio
$5.5 million (To City of Cincinnati)	$2,768,378 (To City of Cincinnati)	1.9:1

Increasing battery storage capacity provides two benefits. First, it strengthens energy security and Cincinnati's ability to withstand climate related disasters and energy shocks. While energy security provides value, the value is not presently quantifiable. Second, battery storage can be used to take energy from the grid during low demand, low price times, and feed that electricity back into the grid during high demand high price periods. A market analysis provided to the U.S. DOE provided current (unsubsidized) cost of storage via five different types of batteries[87]. The cheapest alternative was Zinc-Carbon ($221/kWh) batteries. 25 mWh of storage capacity at $221/kWh would cost $5.5 million.

Given the importance of these batteries for energy resilience in times of crisis, and the likelihood that most of the lifespan of these products, they will not be required for this purpose; there are other purposes that prospective owners may utilize these batteries for. One such is demand management or peak shaving. Charging the batteries during periods of low demand (low price) and discharging them in periods of high demand (high price) can lower energy bills. This is discussed more specifically in the Resilience Chapter, recommendation #7. Scaling the model discussed there: a 25 mWh system can yield $1000 a day in profit, $250,000 in a year (250 charging cycles). The Net Present Value at 3% discount is valued at $2,768,378 over a 20-year period.

Keys to Equity:
● Educate residents on importance of battery storage
● Target buildings that serve low income and underserved sections of the population

Timeline for Implementation
● This recommendation will take 3 to 5 years to implement. Installation of the City's first battery system will happen within 1 year.

Greenhouse Gas Impact

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[87] (Hart & Sarkissian, 2016)

The GHG impact will be minimal as the batteries will just store energy and not offset emissions unless directly paired with a renewable generation source.

9. Promote State policies that encourage energy efficiency and renewable energy.

What is it and why is it important to Cincinnati?

State level energy policy is a key driver of energy reduction and renewable energy growth. The City of Cincinnati will work with outside organizations to lobby the Public Utility Commission of Ohio (PUCO) and the state legislature to make regulations that favor renewable energy generation.
Like Cincinnati, communities throughout the state have voiced support for an energy policy framework that would help residents and businesses achieve economic and energy reduction goals. Cincinnati energy leaders will work to build a network of support throughout the state of Ohio. In collaboration with leaders from other cities, these leaders can more effectively communicate the need for change. The focus of this collaboration should include both state legislative leaders and the Ohio Public Utilities Commission (PUCO), which oversees and implements policy as enacted by the state legislature. The PUCO has significant opportunity to advance energy policies that achieve sustainability goals (in addition to economic and equity goals for a broader range of residents).

Examples of specific policies that the City of Cincinnati may advocate for include: allowing virtual net metering, modifying or removing the setback requirement for wind turbines, support for the Ohio Renewable Energy Portfolio Standard, and opposing subsidies for inefficient power plants.

Examples of Successes in Cincinnati and peer cities.
- **Sixteen States have adopted Virtual Net Metering.**
    - https://ilsr.org/rule/net-metering/updated-states-supporting-virtual-net-metering/
- **Ohio**
    - Renewable energy advocates have stopped several attempts to repeal Ohio's Renewable Portfolio Standard.

Who will be taking the leading roles on this project?

- Statewide energy, environmental and consumer advocate groups.

Who is the target audience?
- Public Utilities Commission of Ohio (PUCO)
- State Legislature

What is the City of Cincinnati's role in implementation?

Cincinnati will partner with organizations and other municipalities

Is it Feasible?

- Feasibility: Hard
- Obstacles:
  - Current political climate may affect renewable energy proposals in the State legislature

How much would it cost?

Lobbying operations within the State of Ohio are likely to incur little expense, if any. The City has many partners who would be served by such a lobbying initiative including other public institutions, companies, private community members or nonprofit organizations. The greatest contribution of the City will likely be personal knowledge and connections. Travel and event hosting will likely consume the bulk of related expenses. The City of Cincinnati's will shoulder the cost burden related to its involvement in furthering lobbying activity.

Keys to Equity

- Changes to state policy could help enable community solar

Timeline for Implementation

- 1-5 years

Greenhouse Gas Impact

Policy changes could help increase implementation of renewable energy projects in Cincinnati. This recommendation does not have direct GHG emissions implications.

FOOD

Creating sustainable and equitable access to local, healthy low-carbon foods while reducing waste

The growing, processing, distribution, consumption, and disposal of food are essential to the life of a city. We believe it is important to create a regional food system that ensures the resilience and long-term viability of our food resources. We have an opportunity to re-fashion a food system that can mitigate and adapt to climate change and shifting population demographics. The strategies laid out in this Chapter build on the collective progress Cincinnatians have made towards greening our regional food system over the last five decades.

Our dietary choices have enormous environmental consequences. In the 2008 Green Cincinnati Plan, we took the pioneering step of articulating that we need to address how our local food choices impact global climate change. Since then, we have worked hard to make the Cincinnati food system more local and sustainable. The goals and work we are undertaking in the 2018 plan are best understood within the context of our foodshed history and the collective input of partners.

This history includes the formation of the Ohio Ecological Food and Farming Association in the 1960s which supported a growth in local sustainable farms during the 1970s and 1980s. In the 1990s and 2000s there was a proliferation of organizations, outlets, and actors that fostered direct farm to consumers relationships such as Community Supported Agriculture and farmers' markets. Other important accomplishments include the creation of farmer and culinary training programs, the establishment of numerous food-manufacturing businesses, and the launch of two food hubs. Annual sales by local farmers and food artisans through these

two food hubs have grown by 586% since 2013, and the Cincinnati metro area is #1 in food hubs per capita as compared to peer regions. These are important steps for understanding and valuing the food we consume.

Supporting this progress, Findlay Market's redevelopment in Over-The-Rhine and organizations such as the Central Ohio River Valley Local Food Guide, the Slow Food Cincinnati Chapter, Our Harvest Cooperative, Ohio Valley Food Connection, Freestore Foodbank, La Soupe, Edible Ohio and Green Umbrella's Local Food Action Team and Greater Cincinnati Food Policy Council have increased our capacity for food system innovations.

While these are solid accomplishments, we know there are challenges to overcome and opportunities to capitalize on. What we eat and how it is produced and distributed critically impact climate change and must be addressed. We need to make healthy, sustainable food more accessible and affordable to all people. We need to increase green food sector jobs that pay more than a living wage and invest in agro-food based economic development that attracts businesses and innovative start-ups. We need both community and citywide composting initiatives and programs. We need education on and adoption of nutritious, sustainable food choices. And we need to nurture public private partnerships that leverage relationships across business, government, healthcare, philanthropy, and higher education to advance our future food system.

There is incredible vitality and promise in the rich networks of people and organizations working towards creating a more resilient, ecologically sustainable and socially just food system for our city and our region. Through engagement with this network we have identified key strategies to collectively pursue over the next five years to build upon the first two Green Cincinnati Plans.

Michaela Oldfield and Alan Wight
Food Team Leads

Goals

1) TRIPLE ACREAGE OF URBAN FOOD PRODUCTION.

City Owned Parcels & Sites for Urban Agriculture in Cincinnati
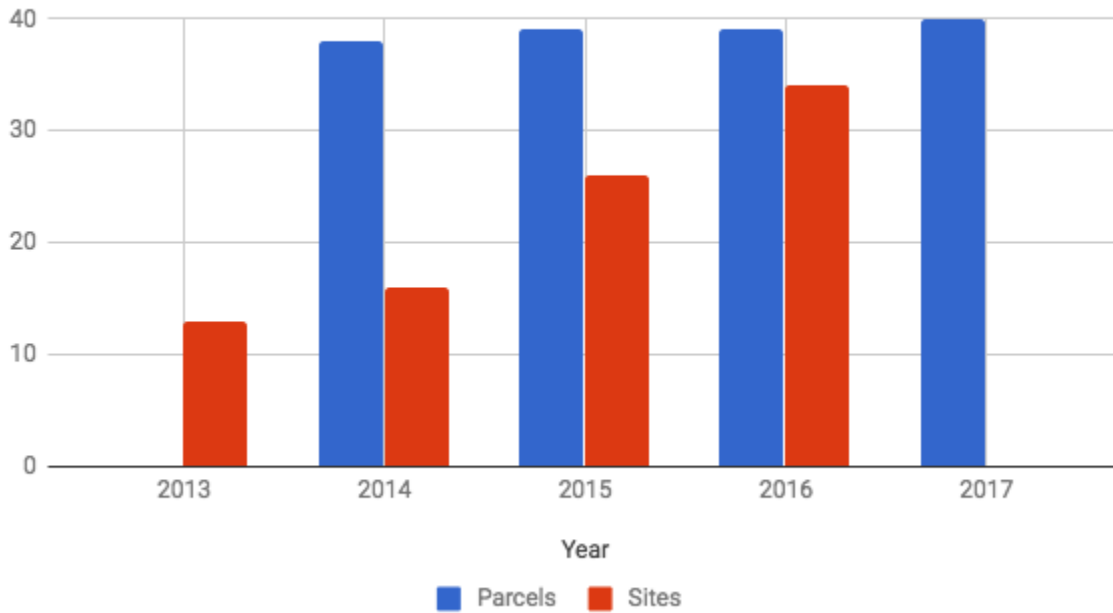
Year	City Owned Parcels for Urban Ag
2017	43
2016	44
2015	44
2014	38
2013	

Currently, data on acreage of land for urban agriculture is unavailable. A surrogate measure is the number of City owned sites and parcels for this purpose. Sizes of both sites and parcels vary. These statistics do not include any privately owned or non-City public land used for urban agriculture. Citation: City of Cincinnati Office of Environment and Sustainability, 2017.

2) REDUCE FOOD WASTE BY 20% BY 2025.

- GCP, 2013: 18,500 tons/year GHG emissions reduced and $185,000 saved from food waste composting in 2012.
- According to a U.S. EPA waste composition study in 2013, Hamilton County throws away 175,000 tons of food every year.

Food waste is food that is discarded uneaten. Waste occurs at all points of the supply chain: production, processing, retailing, and consumption. Food waste calculations were collected by city and county level recycling and solid waste offices. Citation: Green Cincinnati Plan, 2013; Hamilton County, 2017.[88]

3) 100% OF RESIDENTS HAVE CONVENIENT ACCESS TO HEALTHY, AFFORDABLE FOODS.

Growth in Access to Local Food in Cincinnati
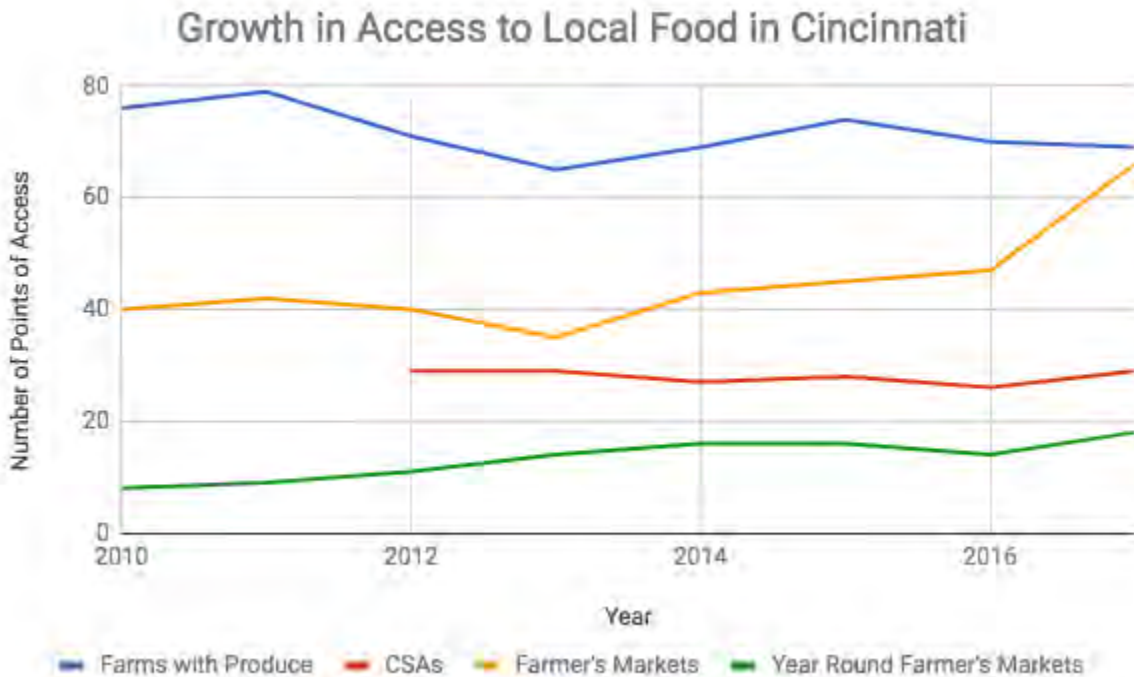
There were 290 places to access fresh local food in Cincinnati in 2017 (projected). The data is broken out by number of farms with produce, CSAs (community supported agriculture programs), and number of farmers markets (total and year-round). Addressing equity concerns, also included are which farmers markets accept low income food assistance such as SNAP, WIC, Produce Perks, etc. Citation: Green Umbrella 2017.

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[88] (Hamilton County Recycling and Solid Waste District, 2017)

General Access to Food

Year	Farms with Produce	Community Gardens	CSAs	Farmer's Markets	Year-Round Farmer's Markets
2017	69	40	29	66	18
2016	70		26	47	14
2015	74		28	45	16
2014	69		27	43	16
2013	65		29	35	14
2012	71		29	40	11
2011	79			42	9
2010	76			40	8

Data provided by Green Umbrella

Low Income Access at Cincinnati Farmer's Markets
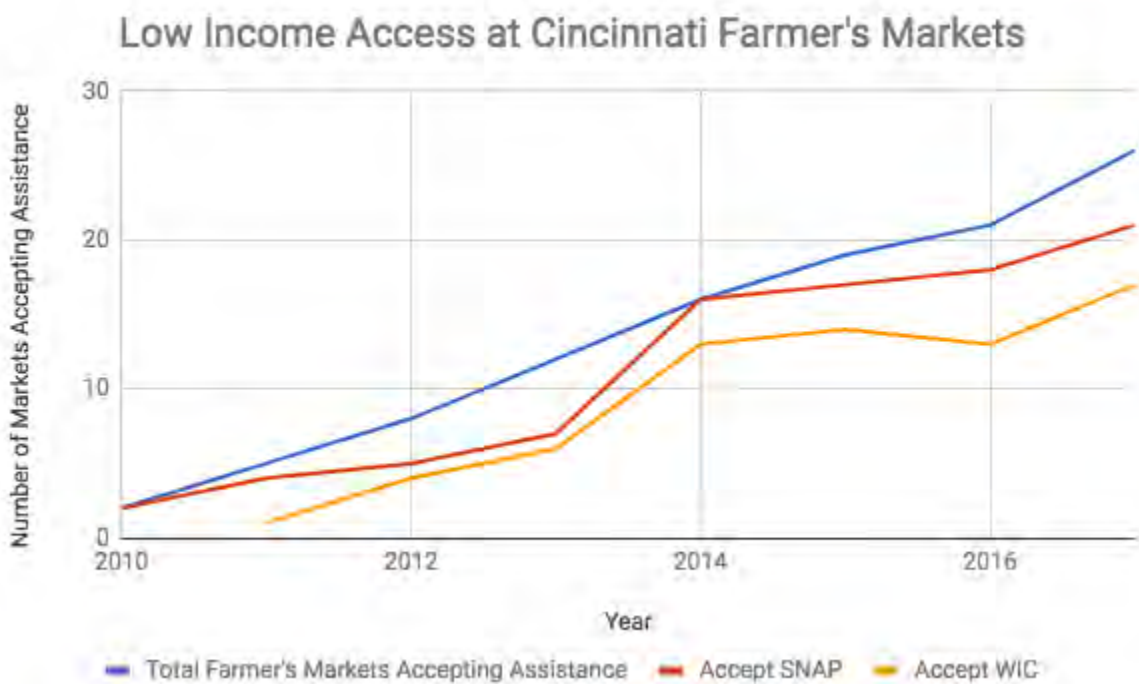
SNAP Access

Year	Farmer's Markets Accepting Assistance	SNAP	WIC	Pro Perks	FMNP
2017	26	21	17	5	3
2016	21	18	13	3	
2015	19	17	14	3	
2014	16	16	13		
2013	12	7	6		
2012	8	5	4		
2011	5	4	1		
2010	2	2			

Data provided by Green Umbrella

4) DOUBLE THE NUMBER OF RESIDENTS CONSUMING LOCAL FOODS.

Draft 2018 Green Cincinnati Plan

Consumption of Local Food in Cincinnati
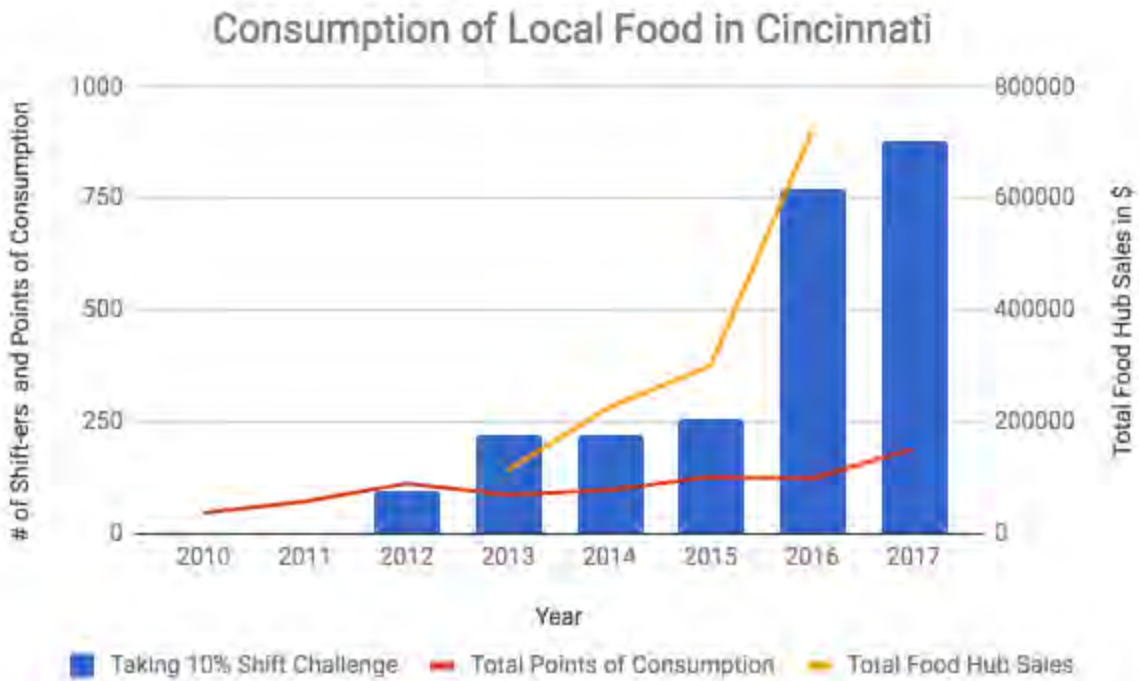
The 10% Shift Challenge is a pledge that individuals can take in the Greater Cincinnati area to shift 10% of their food budget to purchase local food (food produced within 100 miles of Cincinnati). Our Harvest Cooperative and Ohio Valley Food Connection are two food hubs in the Cincinnati area that distribute locally grown produce to individuals and restaurants. General points of consumption that distribute local food include restaurants, artisans, etc. Citation: Green Umbrella, 2017; Our Harvest Cooperative, 2017; Ohio Valley Food Connection, 2017

General Consumption

Year	Total number of Residents Taking 10% Shift Challenge (GU)	Total Points of Consumption (restaurants, artisans, etc.) (GU)	Total Food Hub Sales (OHC, OVFC)
2017	880	189	$711,790 (YTD 9/30/17)
2016	770	123	$300,230
2015	254	126	$225,210
2014	219	97	$112,900
2013	219	86	
2012	96	111	
2011		71	

2010		45	

5) DOUBLE THE NUMBER OF PEOPLE EATING PLANT BASED DIETS.

No data currently exists on the number of Cincinnatians consuming plant-based diets. Annual surveying will begin in the Spring of 2018, utilizing the UC public opinion survey. Final survey language has not been drafted, but may include:

- o Food-frequency questionnaire: structured lists of individual food or food groups, seeking estimation of frequency of consumption, portion sizes, etc.[89]
    - ▪ Vegan-level: vegetables, fruits, legumes, grains, oils
    - ▪ Vegetarian-level: dairy products, eggs, other non-meat animal products
    - ▪ Meat-level: meat, fish
  - ▪ Which best describes your eating pattern?
    - ▪ Vegan
    - ▪ Vegetarian
    - ▪ I make an effort to reduce meat consumption
    - ▪ I eat meat
- ● Number of vegan-friendly restaurants: 49 in Greater Cincinnati Area (Cincinnati Vegan, 2018)

Recommendations

Many of the recommendations of this plan are inter-related, and have multiple benefits. For additional recommendations related to Food, please see:

- *Waste #2: Divert organics from the landfill.*
- *Waste #10: Conduct waste audit to understand the changing composition of our waste stream.*

1. Encourage individuals and companies to prevent, recover, and recycle wasted food.

What is it and why is it important to Cincinnati?

Food waste is an issue that affects every American. Currently in the United States, about 40% of all food is thrown away uneaten, ending up in landfills where it breaks down and releases methane into the atmosphere. Food waste occurs at every stage of the food system: farms; processors; retailers; and consumers, but the biggest share (21%) belongs to consumers. Each American throws away close to 300 pounds of food every year at a cost of about $,1500 for a family of four. Reducing food waste yields many benefits: making food available for the hungry; saving money on grocery bills; saving space in landfills; and reducing GHG emissions and other environmental impacts associated with the production of uneaten food.

Cincinnati will do its part to reduce food waste and will use the following strategies to change the behavior of residents, institutions, and businesses:

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[89] (Agudo, 2005)

a. Conduct campaign focused on prevention of food waste

b. Conduct campaign focused on food waste recovery

c. Strengthen existing food recovery networks and support new channels and applications to distribute food to feed hungry people

Education is important in combating food waste and changing behaviors in our community. The City and its partners will work with grocery stores and other stakeholders to educate consumers on both the economic and environmental benefits of shopping smarter, planning ahead for meals and practicing better storage options. Smarter shoppers buy only the food they know they will be eating that week or buy food they can store for a longer period of time. Educating consumers of the economic benefits of cutting down on food waste can help change consumer habits and shrink the amount of food waste in landfills.

The City will work with education leaders to implement education programs and practices in local schools and universities. Educating the youth and young adults on the impact and prevention of food waste will help in initiating a behavioral change in Cincinnati communities. Students aren't the only ones who will benefit from the programs. Students take the things they learned back home and tell their parents as well as the faculty and staff who are doing the educating.

Changing behavior around food waste in Cincinnati will require more than just an active education program. Principles of Community Based Social Marketing will be used to develop a comprehensive program to reduce the amount of food wasted by residents. Food recovery programs take left over food while it is still edible and use it in soup kitchens and food banks. Food recovery programs in Cincinnati will expand with deployment of technology solutions that help connect leftover food to people that can use it.[90]

What are examples of successful strategies in Cincinnati and peer cities?
- Save the Food Campaign
  - Save the Food is a national campaign to educate Americans about the impact of their food waste and what they can do in their own lives to reduce, reuse, and recycle their food waste.
- La Soupe
  - La Soupe is a Cincinnati non-profit that works with local food distributors and chefs to rescue wasted food and make it into soup for residents who are food insecure. Their work reduces food waste and gets the community involved through volunteering.

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[90] (U.S. Department of Agriculture, 2017)

Case Study: LaSoupe Food rescue

Photo courtesy of La Soupe

La Soupe rescues otherwise wasted produce to create delicious and highly nutritious meals for customers, non-profits and food-insecure families. Each week since 2014, La Soupe rescues 5,000 pounds of perishables and feeds up to 2,000 kids via 47 partner agencies. Some programs La Soupe is a part of are Cincinnati Gives a Crock, Bucket Brigade, Soup Mobile and Stone Soupe. These programs allow La Soupe to recover food, prepare meals for families, distribute efficiently and educate the communities they interact with.

Further Reading: https://www.lasoupecincinnati.com/

Who will be taking the leading role on this project?
- Office of Environment and Sustainability

Who is the target audience?
- All Cincinnati residents
- Businesses and corporations who produce food waste and/or have large cafeterias
- Hospitals

What is the City's role in implementation?

The City will work with partners to create and implement an educational campaign around food waste to educate all Cincinnati residents. The City will utilize resources already available from the Hamilton

County Solid Waste District, and Save The Food. The City will work with partners to deploy a technology solution to match left over food with people who can use it.

Is it feasible?
- Feasibility: Medium
  - The Green Umbrella Waste Action Team is beginning a 2018 campaign to reduce local food waste. With their help, the City will organize a strong local effort around reducing food waste both for residents and organizations.
- Obstacles:
  - Food habits are often developed when people are young. Once they have developed these habits it can be very difficult to get them to change. Limited funding for outreach, and transportation and storage infrastructure may be an additional challenge.

How much would it cost?

Cost (to Close our Calorie Deficit)	Benefit	Cost-Benefit Ratio
$284,190 (Aggregate)	$1,600,000 (To public)	1:5.71

According to the US EPA, food comprises about 38 million tons of waste annually in the United States, which is 22 percent of all discarded municipal waste[91]. The University of South Australia completed a comprehensive food rescue assessment. Upon examination of the waste stream they found a majority of the organic solid waste stream consisted of food, 60% of which was found to be wholesome, edible food. They also considered investment into food recovery and report that per US dollar spent on food rescue, $5.71 (1863 calories) of food was rescued. They also found that food rescue could save 6.6 cubic meters of water, 40.13 MJ of energy, and 7.5 kilograms of greenhouse gases (CO_2 equivalents) from being sent through the waste stream for every $1.00 spent. While food rescue carries a higher cost than composting or landfilling, it is cheaper to save food than to purchase the equivalent amount new.

Further findings report that every dollar spent on food rescue yields 1863 calories worth of food. Based on 3000 calories per person, per day the study estimates that in 2008 the volume of food rescued was enough to feed half of Australia's population[92]. Bringing this back to Cincinnati, Green Umbrella estimates 16% of our population is food insecure, which would be about 340,000 individuals in the Greater Cincinnati Region[93]. Hamilton County Recycling and Solid Waste reports 130,000 tons of food is thrown away into our waste stream per year[94]. To close the nutrition gap in the Cincinnati region (assuming food-insecure person needs 1500 calories a day) the total cost of recovery would be $284,000 (note, this is not an expense to the City of Cincinnati, rather it is an aggregated public expense). To purchase this food new, according to these numbers, would be over $1.6 million. Food recovery offers a cost reduction of 82%. Diverting some of that waste stream can go a long way to closing our caloric deficit. The City has many partners, such as Feeding America's Freestore Foodbank, La Soupe, Food

[91] (U.S. EPA, 2017)
[92] (Reynolds, 2017)
[93] (Green Umbrella, 2017)
[94] (Hamilton County Recycling and Solid Waste District, 2017)

Recovery Network who are instrumental to accomplishing this goal. Pursuing all aspects of Green Umbrella's Greater Cincinnati Food Waste Action Plan will be instrumental.

Keys to Equity
- Save the Food estimates that there is an average of $1400.00 lost annually by a family of four in food that is bought and goes uneaten into the garbage. Planning meals before going to the grocery, learning how to properly store food, and education about how to read and understand expiration dates can help families reduce food waste and save money. Saving money on weekly grocery bills frees up money to be spent on other things, offering new economic opportunities for low-income families in the City.

Timeline for Implementation
- Expected: 1 - 2 years
  - The Save the Food Campaign has resources and guidelines for implementing a successful food waste reduction campaign. Also, the recent focus by other partner organizations will help the City implement this campaign in a short time period. The efforts to reduce food waste will be ongoing.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
3,087 mtCO$_2$e	17,403 mtCO$_2$e	69,940 mtCO$_2$e

Organic waste such as food is converted into methane in the landfill, and reducing food waste would help mitigate emissions of methane from the landfill in Cincinnati. An estimated annual food waste of 130,000 US tons (Hamilton County Recycling and Solid Waste District) equates to 224,000 metric tons of CO$_2$e (watchmywaste.com.au)[95]. We assume Cincinnati generates 50% of Hamilton County's solid waste, and that this recommendation can help reduce food waste 2.5% per year.

2. Promote understanding of the impact of dietary choices and benefits of a plant based diet.

What is it and why is it important to Cincinnati?

For most people, shifting to a plant based diet is one of the largest opportunities to reduce carbon emissions and other environmental impacts. Greenhouse gas emissions from beef production are significantly higher than for any other common food selection. Cattle require a lot of land, food and water to maintain, they create methane that is contributing to the warming climate, and are transported long distances to market. These things have a detrimental effect on our environment. The

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[95] (Watch My Waste, 2017)

public should be educated about these effects and what they can do to reduce their own footprint.

A plant based diet is one that relies primarily on foods sourced from plants, with few or no animal-derived foods included. Currently, 3.2% of adults in the U.S. are vegetarians, and an additional 10% of U.S. adults eat plant based diets including very limited amounts of meat. World-wide, more than 4 billion people (more than 50% of the world's population) consume a vegetarian or plant-based diet.

People who choose a plant based diet cite many different reasons for their choice, including health, religion, environmental protection, animal rights, economics, and reducing human hunger. Beef production has an especially large carbon footprint because ruminants (cows) emit methane from their digestive tracts, and because large amounts of land and fossil fuels are used in beef production.

The City will work with CPS and local universities to educate students on the importance of reducing reliance on meat and the benefits of incorporating a plant-based diet into their lifestyle. One focus will be on the health benefits of incorporating more plants and less meat into peoples' diet, including a reduced risk of heart disease, lower blood pressure, and a reduced risk of cancer. By shaping the dietary choices of Cincinnati children and young adults, they are learning sustainable behaviors for the future. Educating adults about a plant-based diet is important also. The City will work with institutional kitchens (especially hospitals) and interested chefs to adjust menus to be more plant-forward. This will create more and easier opportunities for residents to eat healthier, more sustainable diets.

What are examples of successful strategies in Cincinnati and peer cities?
- Meatless Monday [96]
  - A campaign founded by the Johns Hopkins University School of Public Health, which is now promoting plant based diets in 44 nations.
- Good Food Purchasing Program
  - Adopted by the Los Angeles, Oakland, San Francisco, and Chicago, school systems, encourages purchasing of less meat and more sustainable protein in institutions.
- The Healthy Food in Healthcare
  - A pledge that dedicates hospitals to using their purchasing power and position to improve the healthfulness and sustainability of the food system.

Who could help lead this project?

Who is the target audience?
- All Cincinnati residents

What is the City's role in implementation?

The City will work with local partners to create a campaign to be implemented around the City that will educate residents of the benefits of eating a plant-based diet.

Is it feasible?

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[96] (Meatless Monday, 2017)

- Feasibility: Hard
  - o The City has started this campaign by promoting meatless Monday around the City. An attempt at Meatless Monday in CPS schools was unpopular with parents, and other initiatives that have sought to reduce the amount of meat on menus have met firm resistance in the past. Work is still needed on educating consumers about the health and environmental benefits of eating less meat.
- Obstacle:
  - o It is very difficult to change daily habits such as eating.

How much would it cost?

Cost	Benefit (10% Savings Achieved)	Cost Benefit Ratio
$25,000 (To City of Cincinnati)	$100,000 (To public)	1:4

According to an analysis provided by Xavier University, the development of this type of initiative, relying on promotion, can primarily be accomplished via circular advertising. Methods might include production and dispersion of handouts at City events, food hubs, farmers markets, groceries, fitness centers and other related venues. The cost benefit analysis produced at Xavier assumed that the City invested $2000 annually on the tangible messaging and $2500 one time on the development of social media ad campaigns. A part time position focused on getting the word out would bring the cost of the campaign to about $25,000 per year.

Some research in the field has attempted to pair transition towards plant based diets with quantifiable reduction in health care costs and according to the estimates, extrapolating the savings per capita to Cincinnati's populations. This action could save the City around $1 million. Per person benefits would be high in a developed place such as Cincinnati, due to the higher opportunity for reduction in red meat consumption and caloric intake[97]. The true extent of savings is limited by the receptivity of Cincinnatians to this dietary enhancement.

Keys to Equity

Reducing one's meat consumption decreases the likelihood of heart disease, diabetes, and stroke. Helping people live healthier lifestyles means less money spent on doctor visits, and more money back in the pockets of Cincinnati residents. Moving toward a plant-based diet also reduces one's cost of groceries as meat is generally one of the most expensive food groups. Reducing meat consumption will help Cincinnati residents save money each week and live a healthier life.

Timeline for Implementation
- 1-2 years

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[97] (Springman, 2016)

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
1,050 mtCO$_2$e	6,757 mtCO$_2$e	32,277 mtCO$_2$e

The potential greenhouse gas emissions savings of this recommendation are high. A study[98] of British diets found personal GHG reductions of up to 47% in individuals that eat no meat versus heavy meat eaters. We assume 5% of Cincinnati residents shift from a medium meat intake (2.05 mtCO$_2$e per person/yr.) to a low meat intake (1.7 mtCO$_2$e per person/yr.) over 5 years, and an additional 20% by 2050. We assume that 1.6% of those people shift to vegetarian over 5 years, and 6.4% by 2050.

3. Create policies and support programs that encourage urban agriculture.

What is it and why is it important to Cincinnati?

Urban agriculture refers to the cultivation, processing, and distribution of locally grown food in and around a City. Urban agriculture offers many benefits to local residents and reduces the cost and footprint of importing large amounts of food. To increase urban farming in Cincinnati, the City will:

> a. Change zoning laws to encourage urban agriculture
> b. Encourage use of existing buildings and infrastructure for indoor farming
> c. Stimulate small businesses and local food production through promotion of alternative forms of agriculture, including organics, rooftop gardens, aquaponics and hydroponics
> d. Plant low maintenance fruit and nut trees in public places
> e. Support existing Community Gardens and establish new ones
> f. Explore use of tax incentives to encourage agricultural use
> g. Support the development of food hubs to air processing and distribution.

Urban agriculture provides residents with access to a healthy and reliable source of food, builds a sense of community, and educates people about where their food comes from and how it's grown. Many people within urban settings do not have their own backyard or a space to have a garden and therefore it is important that each neighborhood works to set aside some land that can be used by community members for urban farming, In Cincinnati neighborhoods where residents are struggling to put food on the table each week, urban agriculture gives people an opportunity to supplement their own diets.

Examples in Cincinnati and Peer Cities
- Detroit, MI
  - In 2013, the City of Detroit adopted a comprehensive urban agriculture ordinance that utilizes the City's many vacant properties to establish community gardens and urban farms to promote neighborhood stabilization.

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[98] (Scarborrough, 2014)

> ▪ http://seedstock.com/2013/04/09/no-stranger-to-urban-agriculture-detroit-makes-it-official-with-new-zoning-ordinance/

- Portland, OR
  - o Portland is an example of a city that has implemented successful urban agriculture policies which have helped to foster a strong community around local food.
    - ▪ http://seedstock.com/2014/04/10/city-of-portland-continues-long-history-of-urban-farming/

Who can help implement this project?
- Office of Environment and Sustainability
- Planning Department
- Department of Buildings and Inspections
- Community and Economic Development

What is the City of Cincinnati's role in implementation?

The City of Cincinnati will be responsible for the updating of zoning laws to ensure they encourage urban agriculture. Additionally, the City will support farmers and gardeners who want to implement urban farms/gardens and provide community outreach to educate residents of the new opportunities available.

Who is the target audience?
- Community development organizations
- Neighborhood councils
- Local farm and garden businesses
- Local food hubs
- Residents without access to affordable, healthy food options

Is it feasible?
- Feasibility: Easy
  - o Dozens of farms, personal and community gardens, and urban agriculture initiatives already exist in Cincinnati. The establishment of the Greater Cincinnati Regional Food Policy Council has helped create an organized effort by public and private actors to develop and advocate for policies expanding urban agriculture in Cincinnati.
- Obstacles:
  - o Zoning laws and land use policies must strike an appropriate balance between encouraging agriculture and protecting adjacent properties from nuisances.
  - o Not enough large parcels of land to do large scale, outdoor production within City limits
  - o Seasonal limitations unless season extension methods are used (i.e. hoop houses)
  - o Limited funding to enhance site preparedness

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio
TBD (To City of Cincinnati)	TBD (To public)	TBD

- The changing of the City's zoning laws and land use policies will create no cost for the City. However, the implementation of education and outreach programs to community members will present a cost.
- For those who wish to participate in a community garden, there is usually a small rental fee for the plot, but the savings they can acquire from growing their own produce rather than purchasing it far outweighs that fee.
- The costs and benefits of indoor farms and businesses focused on local food must be evaluated project by project.

Keys to Equity

Urban farms and community gardens have a positive impact on equity. Food security is a major issue throughout Cincinnati and urban agriculture can offer a source of affordable, healthy food for residents. Community gardens are especially good for addressing equity because they get residents outside learning how to grow their own food, provide them with a reliable source of healthy food, and offer them significant savings on their weekly grocery bills. To ensure they are addressing equity, the City should prioritize conversations in food deserts about the potential creation of community gardens and other agricultural solutions in those communities and work with community leaders to develop outlets for the locally grown food. It is also imperative that the City works to support other outlets and programs that provide access to affordable, sustainable food for residents who cannot or choose to not garden.

Timeline for Implementation
- Expected: 1-2 years
    - Changing the City's zoning laws will not take very long, but it will take years of active oversight and outreach to ensure these zoning changes help spur increased urban agriculture.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
96 mtCO$_2$e	480 mtCO$_2$e	480 mtCO$_2$e

The greenhouse gas emissions footprint of food production and distribution in the United States is complex. Greenhouse gases are emitted during crop growing and maintenance; animal agriculture; and food processing, transportation, distribution and sale; and from food waste. This recommendation

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would help reduce the greenhouse gas emissions footprint of Cincinnati's food system by reducing the distance that food is transported and by reducing the amount of meat consumed in the average Cincinnatian's diet. A study[99] estimates that maximizing urban farming opportunities in a city reduces greenhouse gas emissions by up to 0.0064 $mtCO_2e$ per person per year. We assume that for a population of 300,000, policies to encourage urban agriculture will yield a 5% annual increase in local food production and consumption for the first 5 years.

4. Increase the public and private land used for local food production.

What is it and why is it important to Cincinnati?

Throughout the Cincinnati area, there is public and private land that has been abandoned or sits vacant offering no positive value to the neighborhood. The City will identify these spaces and encourage their use for urban agriculture. Currently, more than 40 parcels of City-owned land and many parcels of privately owned land are being used to grow food in Cincinnati. One major threat of climate change is drought, which can lead to food shortages and a spike in food prices. By encouraging the use of local land for the growing of food, Cincinnati will have a partial source of food in time of need and provide residents a supply of locally sourced food.

Identifying vacant lots, abandoned buildings, and other urban spaces that are not in use, and making that land available for urban agriculture creates economic opportunities, provides an environmental benefit, and gives the City a reliable source for local food in the case of a crisis. These abandoned spaces are also opportunities to create urban farms in neighborhoods who may not have access to affordable healthy food options. There are hillsides and other spaces throughout the city that are not well suited to growing vegetables but where orchards can be planted providing one more source of local produce. Putting the source right in the neighborhood allows residents to know and even see where their food is coming from while reducing the cost and impact of transporting the food long distances.

The first step is to identify the spaces around the City, public or private, that would be the best locations for producing food. The City must also identify local food producers who are interested in using these vacant spaces. For the owners of the property, this is an opportunity to sell or rent out their land that is currently not being used. For local food producers, they will have the opportunity to locate space throughout the City they could utilize for farming rather than growing in rural communities around Cincinnati and having to pay to transport their produce to market. Finally, Cincinnati residents will benefit from the increased access to affordable healthy food from a local source.

Examples of land use practices for local food production in Cincinnati and Peer Cities
- Columbus, OH
  - The City of Columbus offers incentives to groups or individuals interested in starting community gardens and urban farms on City owned land bank properties where buildings once stood.
    - Source: https://www.columbus.gov/getgreen/Resource-Protection-and-Conservation/

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[99] (Goldstein & Hauschild, 2017)

- Madison, WI
  - The City of Madison has created a map to identify vacant land parcels around the City that could be made available for urban agriculture. The formation of the Community Garden Committee has also helped the city to create an organized and ongoing effort to increase land set aside for local food production by 200%.
    - https://www.cityofmadison.com/sustainability/documents/SustainPlan2011.pdf#page=10

Who will be taking the lead role on this project?
- Office of Environment and Sustainability

Who is the target audience?
- Owners of vacant properties
- Groups and organizations interested in starting a community garden or orchard
- Residents interested in growing their own food
- Potential Indoor growers- vacant building to repurpose or vacant lots to place trucking containers (i.e. 80 Acres or Square Root model)
- Startup community and business incubator initiatives

What is the City of Cincinnati's role in implementation?

The City will play the lead role in identifying, reporting, and leasing vacant properties to groups interested in starting a gardens or urban farms. The City will consider tax breaks for property owners who allow their property to be used for urban agriculture. The City will rely on partner organizations to organize and identify community groups and local farmers interested in using vacant and abandoned spaces for urban agriculture.

Is it feasible?
- Feasibility: Medium
  - The City is able to identify vacant land parcels within the City. There are currently 40 City owned land parcels being used for agriculture, but no count of possible additional spaces. Working with the Food Policy Council and the Local Food Action Team will allow the City to identify possible sites within the City and connect them with interested groups and organizations.
- Obstacles:
  - There are many economic and communal benefits of urban farming, but it still will require a small upfront investment to prepare land for growing food.
  - Potential contamination issues with vacant land; would need to have soil testing

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio

$60,000 (initial investment) (To program developer)	$45,000/yr., $225,000 over 5 yrs. (To City of Cincinnati and participants)	1:3.75 over 5 years

Assuming an increase of 10 urban agriculture sites in year 1, estimated cost of $6,000 for startup ($1,000 for land from land bank, $5K water meter) per parcel, $4,100 per site saved annually by municipal govt, $400 per site in food value to the gardener. This initiative has costs that are primarily the discretion of whomever executes the project. Identifying vacant land can be done at little to no cost using topographic modeling which is consistently conducted with both spatial and temporal methods. The methods used to encourage the sale or lease of these lands from current owners to prospective farmers are the areas most likely to incur costs. Abatement of property taxes or sales tax on these properties could be compelling but may not be necessary. The City could conduct outreach to vacant property owners and consult with them about their options if they chose to pursue sale/lease for agricultural initiatives. Pairing this with a method of bringing together land vendors with those looking for space to farm might be all we need to get this initiative running.

Economic literature devoted to benefits herein is not extensive, but job creation, training and business incubation are all commonly cited in relevant literature. Pairing this initiative with farmers markets, CSAs, and food hubs is key to success as they draw buyers from a larger radius than supermarkets and small farmers can yield a higher profit on their investment by selling directly.

Individual gardeners can see savings of $400-500 per season by growing their own food and active use of these lands can reduce the burden on municipal agencies by $4,100 per site due to decreased rates of vandalism, dumping and labor-intensive upkeep. There are consistent findings that nearby gardens raise property values roughly 9-10% in the first five years[100].

Keys to Equity

This recommendation lends itself to a strong equity component for local landowners and local farmers. For local landowners, this is an opportunity to make some money off space that is otherwise going unused. For local farmers, this provides an opportunity to expand to new locations. This is especially true for City owned property which can be leased at no cost to the user. This will also help farmers to reduce the transportation costs of getting their produce to market.

Timeline for Implementation
- 1-2 years
    - If funding for land acquisition and water connections can be secured in the current City budget cycle, new urban agriculture sites could be ready for the 2019 growing season.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050

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[100] (UC Sustainable Agriculture Research and Education Program, 2012)

96 mtCO$_2$e	480 mtCO$_2$e	480 mtCO$_2$e

This recommendation will help reduce the transportation CO_2 footprint of produce consumed in Cincinnati by increasing the amount of local produce available. There may also be an opportunity to increase soil and/or above-ground carbon sequestration through proper land use policies, organic farming practices, appropriate fertilizer use, and tree planting in vacant lots, as described in the Natural Systems recommendations. A study[101] estimates that maximizing urban farming opportunities in a city reduces greenhouse gas emissions by up to 0.0064 mtCO$_2$e per person per year. We assume that for a population of 300,000, policies to encourage urban agriculture will yield a 5% annual increase in local food production and consumption for the first 5 years.

5. Encourage the development and utilization of food hubs, and increase the distribution and processing of locally, sustainably produced foods.

What is it and why is it important to Cincinnati?

Food hubs manage the aggregation, distribution and marketing of locally or regionally grown and produced food to better meet the needs of wholesale buyers. Many small and mid-sized growers in the Cincinnati area are unable to sell their products to large buyers because each grower lacks the quantities needed. Similarly, many large buyers do not source local produce because assembling the quantities they need from multiple small growers is too difficult. By strengthening food hubs, Cincinnati area farmers and value-added food producers will have an additional outlet for their products, and large-scale buyers will have convenient access to fresh, local seasonal produce.

Food hubs provide healthy, affordable local produce through some stores and restaurants where Cincinnatians already get their food. The food hubs work with farmers to implement sustainable growing practices and ensure the produce coming to the food hub is from a quality source that is conscious of the environment.

Currently, Cincinnati has two food hubs, Our Harvest and Ohio Valley Food Connection. By increasing the size and throughput of these food hubs, Cincinnatians can find more fresh healthy local food at more outlets. The City can provide additional support to the local, sustainable food system by considering the following strategies:
   a. Increase local, sustainable foods in City operated meal programs
   b. Encourage purchasing of local, sustainable foods by institutions
   c. Support adoption of the Good Food Purchasing Program

Examples of Food Hubs in Cincinnati and Peer Cities
   ● Ohio Valley Food Connection, Cincinnati
       ○ http://www.ohiovalleyfood.com/
   ● Our Harvest, Cincinnati
       ○ https://www.ourharvest.coop/
   ● Columbus, OH

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[101] (Goldstein & Hauschild, 2017)

     o   https://www.columbus.gov/greenplan/

Who will be taking the leading roles on this project?

Who is the target audience?
- Existing food hubs
- Local farmers
- Wholesale buyers
- Producers of value added products from locally grown agricultural products

What is the City of Cincinnati's role in implementation?

This recommendation will largely rely on third party partners for the organization of local farmers and the expansion of food hubs. The City can support these efforts by connecting local growers, assisting in community outreach, and identifying sources of funding to support a growing local food economy.

Is it feasible?
- Feasibility: Easy
    - The City of Cincinnati has two successful food hubs, with over 500% growth in sales since 2013. The presence of local food groups and organizations, such as Green Umbrella's Local Food Action Team and the Food Policy Council will support future growth and stability of an integrated local food network throughout the Cincinnati region.
- Obstacles:
    - The success of local food hubs relies on their ability to implement an operating strategy based on what they are trying to achieve, who they want to serve, the partners and customers they need to work with, geographic factors, the distribution plan, and other unique factors. Each food hub will have its own unique obstacles. Each one will rely on a diverse network of producers, transporters, retailers, and community leaders.

How much would it cost?

Cost (3 Year)	Benefit (3 Year)	Cost-Benefit Ratio (3 Year)
$322,000 (To City of Cincinnati)	$792,600 (To public and food producers, distributors)	1:2.46

The cost-benefit analysis is based upon the expected sales growth resulting from the recently awarded USDA Local Food Promotion Program grant to Green Umbrella to increase food hub activity in the region. The grant is structured as $322,000 invested over 3 years, and is expected to generate $792,600 of additional local food sales, producing a return of $2.46 for every dollar invested. Based on food hub

activity in the region over the last 4 years, this investment is expected to grow annual food hub sales to $1.2M by 2020.

These projections align well with a cost-benefit analysis conducted by Xavier University based on the financial performance of 15 different food hubs across different regions [102]. Year to year estimations based on annual operation of the food hubs provide median gross annual sales of approximately $1.1M and operational expenses of approximately $905,000, indicating an average return of $1.24 for every dollar invested.

While year to year costs and revenues will vary, these analyses suggest that growth and optimization of our food hubs will have a positive impact on both producers and consumers of these products. Utilizing Green Umbrella data[103] on Food Hub sales, we can compute an approximate growth rate of $160,000 per year. At this rate, we can project that by 2023 the region should sell $1.5 million, which would also accomplish the aforementioned goals of the USDA.

Keys to Equity
Food hubs offer healthy, locally sourced food. To reach urban residents, the food hubs must partner with CSAs, retailers located in disadvantaged communities, and entities that serve food to insecure populations.

For local farmers, local food hubs provide a stable market where they can sell their crops. This allows smaller farmers to have an opportunity to earn a living without having to also be a retailer. It also reduces the cost of transportation since they are operating in a local market.

Timeline for Implementation
- Expected: 3-4 years

Greenhouse Gas Impact

2018	2023	2050
0.3 mtCO$_2$e	1.5 mtCO$_2$e	9.6 mtCO$_2$e

This recommendation is intended to support the local food economy. Local food saves .0064 mtCO$_2$e per person per year. Food hub growth of $150,000/year is enough to feed 50 additional people per year on local food, which saves an additional .3 tons of CO$_2$ per year.

6. Support and expand programs that make healthful foods more affordable for vulnerable populations.

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[102] (Gerencer, Pirro, & Matteson, 2013)
[103] (Green Umbrella, 2017)

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Case Study: Waterfields

Waterfields is an organization that seeks to alleviate the pressures of poverty in disadvantaged communities by providing meaningful employment to local residents at living wages with health benefits to build a more inclusive economy. Waterfields operates an indoor farm where they produce microgreens and other crops using hydroponic techniques, and sell their product to local restaurants and specialty food shops. Waterfields utilizes local capacities in order to build success on the model of CoreChange Cincinnati. Waterfields enables employees to work close to home in disadvantaged neighborhoods while maintaining a profitable and sustainable culinary business model. Waterfields capitalizes on Cincinnati's educational infrastructure, startup culture and Fortune 500 companies to build a network among the community and to leverage regional resources to accomplish their mission. Waterfields has begun to demonstrate their "systemic solutions" in Cincinnati's Lower Price Hill and West End neighborhoods.

Further Reading: https://waterfieldsllc.com/

What is it and why is it important to Cincinnati?

Produce Perks/SNAP Plus (Supplemental Nutrition Assistance Program) provides SNAP recipients in Cincinnati the opportunity to increase their purchases of fruits and vegetables at no additional cost. This program allows residents on SNAP to earn $1 for fruits and vegetables for each $1 they spend on other food, allowing up to an additional $10 to be spent each day on produce. For residents who rely on SNAP, this allows them to purchase healthy food for their families without spending any extra money, putting money back in the pockets of the Cincinnati residents who need it the most. This also increases our region's consumption of plant based meals.

The program is not limited to grocery stores and allows for the Produce Perks to be spent at participating farmers markets and Community Supported Agriculture (CSA) programs. This creates a stronger market for local food producers to sell their products and keeps the money in the local economy. Produce Perks incentivizes buying food that is healthy and local, which is important for creating demand that can support retailers and markets carrying these foods. This is especially important in food deserts where there are not full-service grocery stores and where the additional revenue from nutrition incentives may allow a farmer's market or mobile market to operate.

This program has been steadily growing since its launch in 2014. Currently, there are 17 participating locations within the I-275 loop. Increasing the number of locations would increase program participation, helping farmers and SNAP recipients. Hamilton County Jobs and Family Services will raise awareness and educate SNAP users on the potential benefits of Produce Perks. The City will work with Produce Perks Midwest to expand the number of locations around the City that will accept these perks. For businesses and farmers who participate, they can attract new customers and expand their businesses in a way that gives back to their community.

What are examples in Cincinnati and peer cities?
- Cleveland, OH
  - Produce Perks: http://cccfoodpolicy.org/blog/double-value-produce-perks
- Columbus, OH
  - Produce Perks

Who will be taking the leading role on this project?

Who is the target audience?
- The 18.5% of Hamilton county families who are income-eligible for nutrition assistance

What is the City's role in implementation?

The City will work with local food organizations to expand the number of food distribution points throughout the City and ensure that each one has healthy food options at an affordable price. The City will also work to expand programs such as Produce Perks which offer special benefits to residents who are income-eligible for nutrition assistance.

Is it feasible?
- Feasibility: Easy
  - Cincinnati is already home to many organizations working on issues of providing healthier food to low-income residents.

How much would it cost?

Cost (2014)	Benefit (2014)	Cost Benefit Ratio
$6,469 (To Produce Perks and the City of Cincinnati)[104]	$11,997 (To recipients and food producers)	$1:$1.85

Two analyses were conducted at Xavier University based on available data to show what benefits an expansion of the program would bring:

The first analysis demonstrates a ratio of monetary input to Produce Perks outcomes, according to the USDA, are $1.00:$1.85[105]. Extrapolating this knowledge, if the Produce Perks incentives redeemed increases by $1000 every year for 5 years, the result would be a net benefit of $4,000 put back into the economy. Increasing participation (i.e. increasing marketing, outreach and providing sign-up infrastructure) could yield a marginal increase in estimated benefits.

The second analysis shows that increasing the size of Produce Perks Cincinnati by 25% each year for 5 years would drive positive growth in the economy of the region as a whole. An estimation of $36,611/year would be put back into the economy after 5 years as a result of the expansion. Increasing the number of participating markets by 25% each year would end with 30 participating locations by 2023, which would greatly help Produce Perks reach its goals for growth for the next few years. Below are listed some other economic benefits of the program:
- 73.9 % of farmers participating in the program reported increased revenue after joining the program.
- 82.6% of participating farmers reported an increased customer base as a result of the program.

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[104] (USDA Economic Research Service, 2017)
[105] (The Ohio State University, 2017)

- 90% of SNAP user at a market reported that Produce Perks was the reason they were purchasing from the market.
- $1 spent locally creates 2-4 times the economic impact of a dollar spent non-locally[106].

Keys to Equity

Healthy food is vital to achieving a healthy and sustainable lifestyle. Cincinnati struggles with problems of heart disease and diabetes which can be decreased with a healthy lifestyle. Encouraging residents to eat healthier will reduce their monthly costs on medical bills and allow residents to lead healthier lives. Supporting nutrition incentive programs and other initiatives that make healthy food more affordable will allow residents to eat more plant based foods and allocate their household budgets to other necessities and pleasures of life.

Timeline for Implementation
5 years
  o The goal will be to expand Produce Perks by 25% each year for the next 5 years.

Greenhouse Gas Impact

This recommendation is intended to help provide low-income communities access to healthy fruits and vegetables. This may help reduce the carbon footprint of the diets of participating individuals, however the greenhouse gas impact is expected to be minimal.

7. Encourage and support development of local food system entrepreneurs to increase production and distribution of locally produced foods.

What is it and why is it important to Cincinnati?

The development of a reliable local food system in Southwest Ohio will help reduce the environmental impact of transporting food in from other regions, offer a dependable source of healthy produce for Cincinnati residents, and create a strong market for local farmers to sell their products. To implement a successful local food system, the City will work with regional partners to encourage entrepreneurs to invest in Southwest Ohio. A successful local food system requires the cooperation of farmers, value-added producers, haulers, and food distributors. Without one of these partners, the entire system will quickly fall apart.

It is important to have local sourced food because it keeps money in the local economy, reduces the distance food travels to get to market, and it gives Cincinnati a reliable network of food in case a disaster strikes and food cannot be imported from other regions. Creating a local food network helps to create jobs for residents in the Cincinnati region whether they are growing food to sell, helping transport it to market, creating value-added products or are working in their neighborhood grocery store or other kind of food distribution center.

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[106] (Cleveland-Cuyahoga County Food Policy Coalition, 2014)

Farming can be difficult because the farmer is at the mercy of mother nature. A bad growing season can leave a farmer with little to no crops to sell, and with our changing climate the risk of this occurring only increases. The City will work to create a network of growers, haulers, and distributors to ensure the system will not fail if one of these partners is unable to contribute.

Many Cincinnatians consume more processed foods than fresh foods. This creates an opportunity for local entrepreneurs to turn local produce into value-added products (bread, salsa, soup, etc.) for local sale.

The City will work with regional partners to encourage new entrepreneurs to invest in Southwest Ohio so they can continue to grow and expand the local food network.

Examples in Cincinnati and Peer Cities
- Louisville, KY
  - The City of Louisville is working to develop and promote a comprehensive local food system by 2018.
- Madison, WI
  - The City of Madison is working to improve its local food system by encouraging farmers markets, and other similar food distribution venues, and encouraging in-town agricultural opportunities.

Who will be taking the leading roles in implementation?

Who is the target audience?
- Entrepreneurs
- Farmers
- Food haulers
- Food distributors

What is the City of Cincinnati's role in implementation?

The City of Cincinnati will be responsible for working with existing partners to improve the local food system. The City will also work with these partners to make Southwest Ohio a more attractive place to start a business with a focus on local food.

Is it feasible?
- Feasibility: Medium
  - The Cincinnati region has a developing network for local food, but there are many individuals and companies involved with the local food system that are not aware of one another. The City must work to create a space for the different players to interact so they can learn from one another and work together to create a stronger local food system in the region.
- Obstacles:
  - Local food networks rely on participation from a variety of businesses and organizations to succeed. Without a strong leader that can actively engage partners and work to

expand the existing network, these food networks can be an unreliable source of food.

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio
TBD (To City of Cincinnati and distributors)	TBD (To all aspects of the food supply chain, especially consumers)	NA

This recommendation is one which is heavily involved in the supply chain of food production and distribution. A chief aspect involves creating a more conducive communication between portions of the supply chain so they may make the best-informed decisions. This can bring about products at the best price possible. On the exterior, this can enhance our systems by enhancing traceability; consumers ideally will have very little trouble finding where and when exactly their products come from, how they were transported and the quality of their product. The City is fortunate to already have a devoted network of distribution hubs who have most of this supply line connected. It may be the prerogative of City Hall and/or Green Umbrella to identify and leverage their contacts at larger local distributors (Kroger Inc, etc.) and local unconnected markets to create a more inclusive supply chain. Due to the nature that the City already has professional food systems organizations devoted to this, there is little public cost burden, if any, associated with this recommendation.

Keys to Equity

Encouraging local food entrepreneurs helps to create local jobs. As the local food system expands, more people will be needed to help in the growing, transportation, and distribution of the food. This creates an opportunity for residents to find a reliable job in a growing industry.

This recommendation will also help local farmers to have a reliable market to send their produce to. Without the assistance of food haulers and distributors, it is difficult for smaller farmers to have the time to take care of their crops, get their crops to a farmer's market, and sell their crops. An extensive local food system could help take some stress off local farmers and give them more time to focus on the growing of their crops.

Timeline for Implementation
- Expected: 1 - 2 years
  - There are already many organizations working in Cincinnati to expand and improve the local food system. The first steps the City will take is better connecting the existing local food players in the region and then work with them to create a plan to make Cincinnati a more attractive place for new local food businesses.

Greenhouse Gas Impact
This recommendation is intended to promote the local food production economy. The greenhouse gas impact is expected to be minimal.

8. Support strategies for ensuring food security in ALL communities throughout Cincinnati.

What is it and why is it important to Cincinnati?[107]

The City of Cincinnati has many residents who struggle each day to know where their next meal is coming from. 18.5% of Cincinnati residents are food insecure. That's approximately 55,500 Cincinnatians. 21.1% of all children within Cincinnati suffer from food insecurity. Within Hamilton County, as much as 62% of families are considered income-eligible for nutrition assistance. The City of Cincinnati will pursue the following strategies to ensure food security for all residents:

> a. Promote fresh, local food in food deserts thru neighborhood retail strategies such as Fresh Food Financing, mobile vending, farmers markets, healthy corner store initiatives and kitchen literacy programs
> b. Expand and improve community supported agriculture (CSA), food hubs and other distribution efforts.
> c. Increase local food consumption at sites like senior centers, low-income sites, child care centers and schools.
> d. Promote community-based education on nutrition, and nutritious food preparation, including focusing education on the health and cost-saving benefits of a plant rich diet.

The City of Cincinnati has multiple communities that struggle with food insecurity. A food desert is a community with limited access to fresh fruit, vegetables, and other healthful whole foods. Food deserts often exist where residents do not have access to a full-service grocery store, which may limit their access to affordable, nutritious foods. To address food deserts, Cincinnati should support grocery stores willing to open in a food desert and work with communities to develop and implement other innovative approaches to provide sources of food.

In Cincinnati, children are often impacted by food insecurity. With a 45.5% childhood poverty rate, many children throughout Cincinnati go hungry every day. The City must work with prospective food providers to offer healthy foods such as fruits and vegetables at an affordable price. This ensures that children are not only getting food on their plates, but they are also getting the nutrients necessary for a healthy diet.

Another solution is to create community gardens and encourage neighborhood oriented urban agriculture. These are plots of land that can be rented out to residents that gives them a space to grow their own food. Community gardens are most successful when they are resident-driven and gardeners receive instruction on how to plant and grow their own food. Other urban agriculture models, such as indoor hydroponics, re-use vacant spaces to grow crops for sale in a neighborhood, often employing some residents, selling in neighborhood below market value, and making a profit by selling surplus to high-end markets.

To address the issue of food deserts, the City will work with each affected neighborhood to establish access to reliable sources of food.

What are examples of successful food security strategies in Cincinnati and peer cities?

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[107] (Community Shares of Cincinnati, 2017)

- Columbus, OH
  - The City of Columbus established the goal of reducing food deserts by 10% in their 2015 Green Community Plan with 9 different strategies to achievement.
  - https://www.columbus.gov/WorkArea/DownloadAsset.aspx?id=2147486721
- Madison, WI
  - https://www.cityofmadison.com/sustainability/documents/SustainPlan2011.pdf

Who will be taking the leading role on this project?

Who is the target audience?
- Residents living in food deserts within the City of Cincinnati
- Any residents living in an area without a walkable food store
- Food distributors
- Food security focused urban-agriculture entrepreneurs (e.g. Brick Gardens, FreeStore Mobile Market)

What is the City's role in implementation?
    The City will be an active partner in a coalition working to eliminate food insecurity in Cincinnati.

Is it feasible?
- Feasibility: Hard
  - Implementing successful food distribution systems can be difficult, especially in low income neighborhoods.

How much would it cost?

Cost	Benefit (annual)	Cost-Benefit Ratio (5 year)
$8.55 Million (To City of Cincinnati)	$9.6 million (To public)	5.6

One method to encourage the startup of a grocery store in a food desert would be to offer a tax exemption to developers and entrepreneurs. Abating property tax and sales taxes on transactions related to the construction of a grocery store could be a powerful tool to push the needle on these food deserts. According to estimates from Xavier University the City would forgo roughly $ 3 million in revenues related to property taxes and another $5.5 million would not be collected from a sales tax exemption over a five-year period.

There is intrinsic value to this program, regardless of the means to accomplish it. The benefits result from proper nutrition, and reduction of nutrient deficiency related health complications. Diabetes costs an average of $5,364 per patient per year in medical costs, lost productivity, and premature mortality.[108] With approximately 10% of Cincinnatians suffering from diabetes, a 6% reduction in diabetes would save

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[108] (Ohio Department of Health, 2010)

$9.6 million per year in Cincinnati. Another important consideration is the effect of improved nutrition on children; particularly in development. Proper access to nutrition encourages psychosocial well-being, reduces aggression and school suspensions, and decreases discipline related issues in young kids. Lack of access to nutrition can contribute to cognitive and developmental issues throughout childhood[109]. This initiative can go a long way to helping the City bridge the equity gap in both nutrition, health and especially in our children.

Keys to Equity

Food insecurity is one of the largest problems facing Cincinnati residents. With nearly 20% of the county population living food insecure, and so many of those being children, it is imperative that the City works to improve the current food system. Affordability and promoting healthy foods are vital. At the same time, dietary education must be culturally sensitive to the diverse histories and personal importance of food choices to residents. Access strategies and nutrition promotion must be developed and undertaken in partnership with target communities. The City will continue to work with local food partners to fight food insecurity throughout the Cincinnati region.

Timeline for Implementation
- Expected: 1-2 years
- Many of the strategies outlined in this recommendation are initiatives already underway in Cincinnati, but there is still much work to be done. The City will continue to encourage collaboration between the different parties working on food in the City. Collaboration will allow for an effective food system and will be required to effectively address equity.

Greenhouse Gas Impact

The intent of this recommendation is to provide adequate nutrition to all residents of Cincinnati. There are potential greenhouse gas reductions of food systems in Cincinnati if 1), a shift from a meat-based to a plant-based diet is encouraged (as described elsewhere in this chapter); 2), less processed foods are available to urban residents (processed foods have a higher greenhouse gas footprint than unprocessed foods); and 3), a shift from distant to local foods takes place.

9. Encourage purchasing of healthy, sustainable foods by major institutions.

What is it and why is it important to Cincinnati?

The Good Food Purchasing Program (GFPP) is a point based scoring system used by institutional food buyers across the country to demonstrate their commitment to responsible food procurement. Sometimes referred to as LEED for food, the GFPP awards points in 5 categories: Nutrition; Valued Workforce; Local Economies; Environmental Sustainability; and Animal Welfare. In each of the 5 categories, there is a baseline level of performance that is required of all program participants, and points that are awarded for accomplishments or certifications beyond the required baseline.

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[109] (Amherst Wilder Foundation, 2014)

Institutional food buyers in Cincinnati will be encouraged to practice responsible procurement, and to demonstrate it through participation in the GFPP or in another way.

Examples in Cincinnati and Peer Cities

- Los Angeles, Oakland, San Francisco, and Chicago Public Schools have adopted the Good Food Purchasing Program.
- Hundreds of hospitals and Food Service Contractors across the United States have signed the Healthy Food in Health Care Pledge, including St Elizabeth's in Kentucky and TriHealth in Cincinnati.

Who will be taking the leading roles in implementation?

Who is the target audience?

- Institutional kitchens

What is the City of Cincinnati's role in implementation?

The City will work with the lead organizations to encourage responsible procurement by institutional food buyers.

Is it feasible?
- Feasibility: Medium
  - The Cincinnati Good Food Purchasing coalition is comprised of stakeholders with diverse interests in the health and sustainability of the food system. The coalition has successfully obtained endorsement of the GFPP by all current members of the CPS School Board and is partnering with the National Center for Good Food Purchasing to undertake a campaign for adoption of the GFPP throughout Cincinnati.
- Obstacles:
  - It can be difficult for a large organization to get alignment on multiple priorities simultaneously.

How much would it cost?

Cost	Benefit (annual)	Cost-Benefit Ratio (5 year)
TBD (To City of Cincinnati and Institutions)	TBD (To institutions)	NA

Keys to Equity
- Special efforts will be made to reach institutions serving disadvantaged populations.

Timeline for Implementation
- Expected: 1 - 2 years
  - There are already many institutions in Cincinnati dedicated to adopting healthier, more sustainable menus.

Greenhouse Gas Impact

While a Good Food Purchasing Program will increase the amount of local and plant based foods served by institutions in Cincinnati, it would be premature to forecast the magnitude of those shifts.

NATURAL SYSTEMS

Protecting the air, water, and land in Cincinnati

The Natural Systems Task Team was charged with the critical task of examining how the City of Cincinnati can continue the tremendous progress that has been made over the past 5 years in improving the City's water quality, air quality, and green space. We sought to build upon recent accomplishments and momentum, such as the formation of the Cardinal Land Trust, restoration of the Mill Creek watershed, steady progress on reduction of Combined Sewer Overflows, and the planting of over 300,000 trees because of the Taking Root campaign and other initiatives.

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As part of this examination, the group also focused on issues of equity, sustainability, and resilience. It was observed that there are some communities with tree-lined streets, and others where pavement is easier to find. We noticed that some neighborhoods have worse air quality than others, and childhood asthma rates that reflect that. We tried to identify solutions that would benefit all Cincinnatians.

Through multiple meetings involving people from many walks of life, the Task Team's conversations honed in on opportunities to increase tree canopy coverage, capitalize on the shift to alternative energy and electric vehicles to further improve air quality, improve watershed management to decrease flooding, celebrate the Mill Creek as a major asset to Greater Cincinnati, and re-connect green spaces and people.

Below you will find the recommendations of the Natural Systems Task Team. We hope we will have your help in making these happen!

Dave Schmitt
Natural Systems Team Lead
MC2 – Mill Creek Watershed Council of Communities & Groundwork Cincinnati

Goals

1) ATTAIN 100% OF US EPA NATIONAL AMBIENT AIR QUALITY STANDARDS.

Pollutant	National Standard	Greater Cincinnati Design Values for reporting year 2016
Carbon Monoxide	35 ppm (1-hour) (not to be exceeded more than once/year) 9 ppm (8-hour) (not to be exceeded more than once/year)	1.8 ppm (1-hour) 1.4 ppm (8-hour)
Nitrogen Dioxide	100 ppb (1-hour) (98th percentile of 1-hour daily maximum concentrations, averaged over 3 years) 53 ppb (annual) (Annual Mean)	57 ppb (1-hour) 21 ppb (annual)
Ozone	0.070 ppm (8-hour) (Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years)	0.073 ppm (8-hour)
Sulfur Dioxide	75 ppb (1-hour) (99th percentile of 1-hour daily maximum concentration averaged over three years)	48 ppb (1-hour)
Particulate Matter$_{2.5}$	35 µg/m^3 (24-hour) (annual mean, averaged over 3 years) 12.0 µg/m^3 (annual) (annual mean, averaged over 3 years)	24 µg/m^3 (24 hour) 10.7 µg/m^3 (annual)
Particulate Matter$_{10}$	150 µg/m^3 (24-hour) (Not to be exceeded more than once per year on average over 3 years)	87 µg/m^3 (maximum)

Lead	0.15 µg/m^3 (3-month rolling)	Not required to monitor since the level is so low

Previous year statistics above the level of air quality standard:

· 2016: Ozone 8-hour max: 0.076
· 2015: Ozone 8-hour max: 0.072; PM 2.5 Weighted Mean: 12.5
· 2014: Ozone 8-hour max: 0.073; PM 2.5 Weighted Mean: 13.3
· 2013: Ozone 8-hour max: 0.072; PM 2.5 Weighted Mean: 13.3

The National Ambient Air Quality Standards data are collected at outdoor monitors across the nation. The values provided are the annual medians, which are calculated from daily measurements. Citation: U.S. EPA National Ambient Air Quality Standards, 2017

2) INCREASE CITY-WIDE TREE CANOPY COVERAGE TO AT LEAST 40%, ENSURE ALL RESIDENTIAL NEIGHBORHOODS TO 30% TREE CANOPY COVERAGE.

Community	Existing Tree Canopy
Avondale	32.00%
Bond Hill	28.00%
California	48.00%
Camp Washington	19.00%
Carthage	24.00%
Clifton	39.00%
College Hill	50.00%
Columbia Tusculum	
Corryville	11.00%
CUF	41.00%
Downtown/ CBD	3.50%
East End	31.00%
East Price Hill	47.00%
East Walnut Hills	34.00%
East Westwood	
English Woods	
Evanston	34.00%
Hartwell	30.00%
Hyde Park	30.00%
Kennedy Heights	37.00%
Linwood	32.00%
Lower Price Hill	21.00%
Madisonville	39.00%

Millvale	
Mt. Adams	38.00%
Mt. Airy	54.00%
Mt. Auburn	31.00%
Mt. Lookout	48.00%
Mt. Washington	34.00%
North Avondale	34.00%
North Fairmount	53.00%
Northside	37.00%
Oakley	33.00%
Over-the-Rhine	19.00%
Paddock Hills	
Pendleton	
Pleasant Ridge	33.00%
Queensgate	13.00%
Riverside	31.00%
Roselawn	33.00%
Sayler Park	48.00%
Sedamsville	50.00%
South Cumminsville	39.00%
South Fairmount	39.00%
Spring Grove Village	35.00%
Villages at Roll Hill	46.00%
Walnut Hills	34.00%
West End	14.00%
West Price Hill	36.00%

Westwood	47.00%
Spring Grove Village	40.00%
Citywide	39.00%

3) MEET EPA RECREATIONAL WATER QUALITY CRITERIA IN 90% OF CINCINNATI WATERWAYS, 90% OF THE TIME.

4) HAVE A PARK OR OUTDOOR RECREATION SITE WITHIN A 10 MINUTE WALK OF EVERY CITY RESIDENT.

Currently, 76% of City residents live within a 10-minute walk of a park or outdoor recreation site. The national average for major cities is 55%.
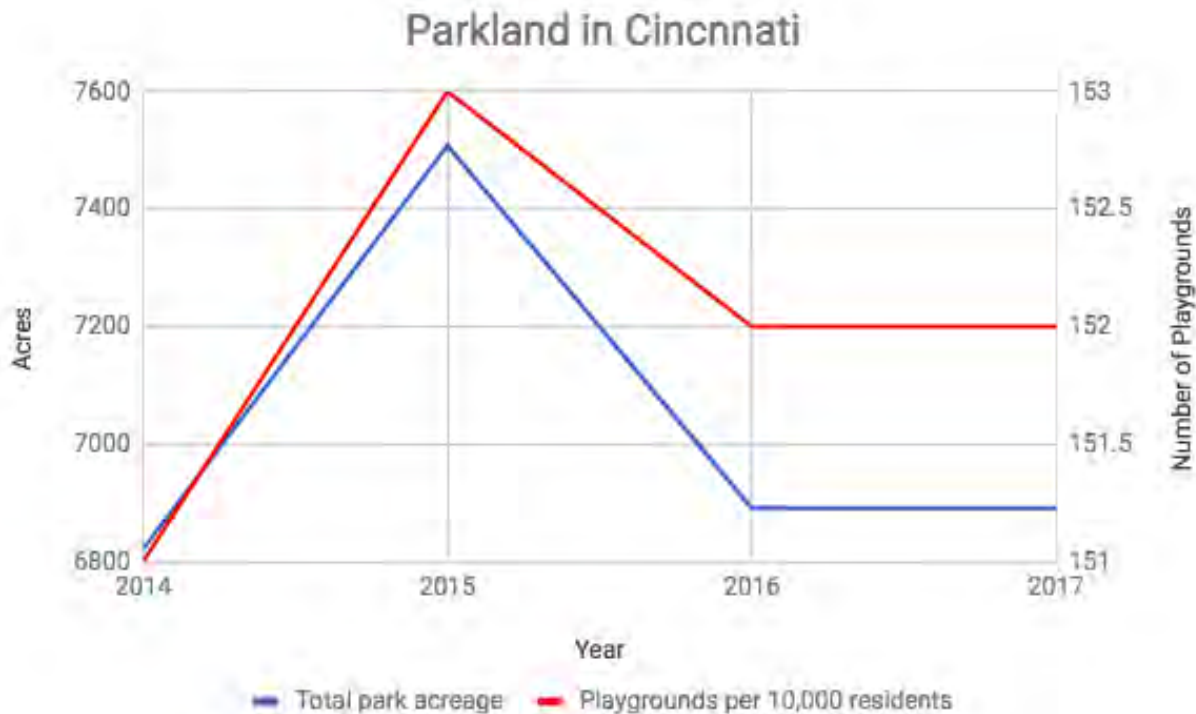
Trust for Public Land "City Parks Facts Reports" from 2014-2017

Recommendations

Many of the recommendations of this plan are inter-related, and have multiple benefits. For additional recommendations related to Natural Systems, please see:

- *Built Environment #9: Require or incentivize Low Impact Development for new developments and infrastructure.*
- *Resilience #5: Encourage onsite stormwater retention and infiltration and discourage runoff by restructuring sewer and/or stormwater fee.*

- *Resilience #6: Conduct Urban Heat Island Assessment.*

1. Implement water loss control program to reduce water loss due to leakage.

What is it and why is it important to Cincinnati?

US EPA estimates average water loss of 16% in water systems due to leakage, unauthorized consumption, and administrative errors. Treating water so that it is safe for residents uses between 1,000 and 3,000 kilowatt hours of electricity per million gallons- a very energy intensive process that contributes to large amounts of carbon being emitted into the atmosphere. EPA estimates that a water loss control program, including a water loss audit, can help reduce water loss up to 75%.[110]

Examples in Cincinnati and peer cities
- Corvallis, Oregon
  - The City of Corvallis, Oregon provides information for residential customers on checking for leaks using the water meter, measuring or estimating flows in plumbing fixtures and measuring water used in landscaper irrigation.
  - http://www.ci.corvallis.or.us/index.php?option=content&task=view&id=443&Itemid=384
- Duluth, MN
  - Duluth is working to improve water conservation efforts through infrastructure upgrades that will also allow them to be more resilient after extreme weather events
  - http://www.duluthgov.info/sustainability/img/Poster_lg.jpg

Who will be taking the leading roles on this project?
- Greater Cincinnati Water Works

Who is the target audience?
- GCWW treatment and distribution system
- Residents
- Commercial Buildings
- City Facilities

What is the City of Cincinnati's role in implementation?
- The Greater Cincinnati Water Works will identify and address sources of water loss.

Is it Feasible?
- Feasibility: Medium
  - It is very feasible because GCWW and peer cities have implemented measures to reduce water loss. There will be a cost to implement infrastructure improvements.

How much would it cost?

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[110] (U.S. EPA, 2013)

Cost	Benefit annual leak mitigation	Cost-Benefit Ratio leak mitigation
Up to $5 million (To GCWW)	Up to $21.53 million (To GCWW)	1:4.25

Water loss due to leakage and unauthorized use may represent a significant cost for Greater Cincinnati Water Works (GCWW). Losing 16% of production gallons equates to a loss of over 6.89 billion gallons of clean water valued at $27.8 million dollars in 2017 (assuming a production cost of $1.10 per cubic meter of water).

If water loss is reduced by 75% (in accordance with EPA estimates) that would mean saving 5.17 billion gallons of water in 2017 which equates to $21.53 million in cost reductions at $1.10/cubic meter.

The first step to this program is a water audit utilizing American Water Works Association's standard methodology. Once initial evaluation is complete, data validation is key[111]. The cost intensive part is leak detection and meter evaluation.

From 2000-2011, Philadelphia conducted a similar program (albeit focused entirely on leaks). While costs varied from year to year, they found annual leakage detection costs of $800,000 and savings, due to chemical and electricity reductions, of roughly $3.4 million annually. This is a cost-benefit ratio of roughly 1:4.25.[112]

Keys to Equity
- Reduce water waste to keep rates affordable for all residents.

Timeline for Implementation
- This recommendation will take 3 to 5 years to implement.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
0	4,404 mtCO$_2$e	8,808 mtCO$_2$e

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[111] (Natural Resources Defense Council, 2015)
[112] All Water inventory data provided by Greater Cincinnati Water Works Annual Water Quality Reports and rate structures.

In 2015, emissions from water totaled 88,086 metric tons of CO_2e. Average national water loss is 16%. We assume water loss control program could help reduce water loss to 11% over 5 years, and to 6% by 2050. [113,114]

2. Increase tree canopy and access to greenspace.

What is it and why is it important to Cincinnati?

The City of Cincinnati will work with Taking Root and Cincinnati Parks to increase the tree canopy throughout the city, especially in low income neighborhoods and along the interstates. Increasing the City's tree canopy will help minimize the effects of urban heat islands, provide stability to land that is prone to landslides, reduce the cost of cooling for residents, reduce stormwater runoff and flooding during heavy rains, and reduce the concentrations of air pollutants. Planting efforts will align with the goals set forth in the Cincinnati Park Board's Natural Resource Management Section Management Plan. The City will explore funding options to restore the Park Board's ReLeaf program to provide trees that can be planted on public or private property.

One tool to improve tree canopy in deficient neighborhoods will be the creation of parks or other protected greenspaces in locations where residents lack walkable access to greenspace.

Taking Root is a coalition of organizations committed to planting 2 million trees in the Cincinnati region by 2020. Over the past 5 years, Taking Root's "Registree" has recorded the planting of nearly 300,000 trees. While planting an additional 1.7 million trees in the next 3 years seems unlikely, an increase in the current rate of tree plantings will provide tremendous benefits. Planting trees in areas that have inadequate tree canopy will provide more shade, less stress on air conditioners, and lower temperatures on hot days. Residents will experience less extreme temperatures and less of the adverse health effects that come along with it. Neighborhoods with high concentrations of disadvantaged residents often have inadequate tree canopies, so planting trees in these neighborhoods will help reduce inequity.

Planting trees in areas that contain a high percentage of impermeable surfaces will help absorb rainwater and reduce flooding. Trees can also be used to keep hills next to the interstate from sliding when rain comes. Trees are a carbon sink. They soak up carbon dioxide and convert it into organic carbon. As a tree matures, it can absorb up to 48 lbs. of CO_2 per year which can have a large impact over the lifetime of a tree. Trees also filter out pollutants from vehicles and other sources.

Recognizing climate and pest related stresses on our ecosystem, tree planting efforts should be mindful of increasing the species diversity that makes up the urban tree canopy. Tree planting efforts should also consider removal of invasive species which can prevent and inhibit the growth of beneficial species.

Examples in Cincinnati and peer cities
- **Taking Root in Cincinnati**
    - A campaign that focuses on planting trees and better managing local forests
    - http://www.takingroot.info/about/about-us/

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[113] (City of Cincinnati, 2015)
[114] (U.S. EPA, 2013)

- **Tree Pittsburgh**
  o Created to protect and restore urban forests and improve the City's tree canopy through tree planting and advocacy http://www.northhillsmonthly.com/2017/04/02/138272/tree-pittsburgh-planting-the-seeds-of-the-city-s-future

Who will be taking the leading roles on this project?

- Cincinnati Parks Board
- Taking Root
- Cincinnati Permaculture Institute

Who is the target audience?

- Land Owners
- Landscapers and Tree Professionals
- City Parks Department
- Local Environmental organizations

What is the City of Cincinnati's role in implementation?

- The City's role will be to provide aid to a team of organizations that campaigns and provides programs to help increase the number of trees planted throughout the city.

Is it Feasible?
- Feasibility: Easy
  o It is highly feasible to increase the pace of tree plantings in Cincinnati. There are already campaigns and programs in place and this recommendation can be used to accelerate the process and create more initiatives.

How much would it cost?

Cost (10 year, 100 trees)	Benefit (10 year, 100 trees)	Cost-Benefit Ratio
$51,000 (To Cincinnati Parks)	$510,000 (To Cincinnati Parks)	10

According to a Cost Benefit analysis provided by Xavier University, a rough cost estimate runs around $31,000 for proper planting and initial care for every 100 trees and a rolling maintenance estimate of $20 per tree per year. Savings related to stormwater retention, enhanced property value and reduced energy bills due to increased coverage were nearly ten times the monetary costs in ten years and more as trees age.

Keys to Equity:
- Focus tree plantings in areas with the lowest tree canopies which tend to be the most disadvantaged areas

- Target areas that suffer from the Urban Heat Island effect
- Educate residents on how trees can lower surrounding temperatures as well as save on air conditioning cost
- Provide jobs to incarcerated individuals and members of work release programs to provide useful work skills

Timeline for Implementation

Tree planting is already taking place in Cincinnati. Efforts to accelerate the planting of trees will begin as soon as locations are identified for trees to be planted and trees are available to plant. Trees will be planted in locations that will have the greatest impact both environmentally and economically.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2035	2050
0 mtCO$_2$	1770 mtCO$_2$	3,333 mtCO$_2$

We used a CO2 sequestration rate for urban trees in Ohio of 0.248 kg C per m^2 per year (Nowak et al., 2013). An average sized tree's crown covers 28 square meters. The goal will be to plant 15,000 trees each year. In 2035, this would result in uptake of 1770 mtCO$_2$e/year. By 2050, this would remove 3,333 mtCO$_2$e/year from the atmosphere.[115]

3. Create and expand wetlands.

What is it and why is it important to Cincinnati?

The City of Cincinnati will work with the Parks Department and other partners to recreate and expand wetlands throughout the area. A wetland is an area that is saturated with water either permanently or seasonally. Cincinnati receives heavy rainfall and the geography of the city causes flooding in certain areas. Increasing wetland areas throughout the city will reduce floods when large rain events occur because the water will have a temporary place to go until it is absorbed by the ground.

The City will focus on sites where wetlands save more money than they cost by contributing to MSD's obligation to reduce CSO's (Combined Sewer Overflows), or by reducing MSD's liability for basement flooding. Management of the created wetlands by the Parks Department will enable a balance between creation of wildlife habitat and creation of public spaces that residents can use when they are not flooded or saturated.

Increasing and maintaining current wetlands will help to reduce the amount of damage from large rain events. If these wetlands are put in areas of low-income, the residents can benefit from the reduction in

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[115] (Nowak, Greenfield, Hoehn, & Lapoint, 2013)

flooding and gain recreation space during dry periods. Placing these wetlands strategically will also help reduce the amount of pollution that gets into the rivers because they will act as a natural filtration system that rids the water of pollutants.

Examples in Cincinnati and peer cities
- **Madison, WI**
    - Madison is working to change zoning codes in favor of protecting wetlands by reducing pollutants and development that can take place in vulnerable areas
    - https://wisconsinwetlands.org
- **Columbus, OH**
    - Columbus is working to adjust development codes to deter developers from developing wetlands and providing protection for sensitive wetland areas
    - http://epa.ohio.gov/portals/47/facts/ohio_wetlands.pdf

Who will be taking the leading roles on this project?

Who is the target audience?
- Parks Department
- Developers

What is the City of Cincinnati's role in implementation?
The City will work with outside organizations to protect and create wetlands.

Is it Feasible?
- Feasibility: Easy
    - It is very feasible because peer cities have implemented similar recommendations

How much would it cost?

Cost per acre	Benefit per acre/per year	Cost-Benefit Ratio (5 year)
$23,000 (To Cincinnati Parks)	$23,000 (To Cincinnati Parks)	~1:5

A Cost Benefit analysis of this recommendation completed at Xavier University examined three projects which could be used as case studies where local partners took a leading role in creation and expansion of wetlands. An average estimate of initial construction and land assembly costs was $60,349.

According to a study in the state of Washington, the cost to create an acre of wetlands starts at $23,000 but can be significantly higher based on local conditions. The monetary benefits derived from an acre of wetlands start at $23,000 per year, and can be significantly higher depending on the setting.[116]

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[116] (Patora, 2009)

Keys to Equity:
- Educate all residents on the benefits of protecting wetlands

Timeline for Implementation
This recommendation will take 2 to 3 years. A pilot site for wetland creation can be identified in year 1.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
13.2 mtCO$_2$	65.8 mtCO$_2$	421 mtCO$_2$

The primary benefits of this recommendation include the control of stormwater runoff and habitat restoration. Analysis of the carbon sequestration and the methane release activity of wetlands indicates a net sequestration of 3.25 mtCO$_2$e per hectare annually. We assume 10 acres of watershed restoration per year.[117]

4. Develop a carbon offset program to fund tree planting efforts.

What is it and why is it important to Cincinnati?

Urban trees provide numerous benefits, including shade to cool buildings and reduce energy consumption, absorbing rainfall, improving air quality, and sequestering carbon. Tree planting is a central strategy to many sustainability and resiliency goals.

To fund urban tree planting efforts, a carbon offset program will be developed. The program will allow individuals and businesses to calculate the carbon emissions generated by their daily activities, and voluntarily purchase trees to be planted to offset those emissions. Participants can choose between a street tree or a park tree, and whether to make a one-time purchase, or a regular monthly purchase.

This program may help restore funding for the ReLeaf Program, which provides free or low-cost trees to residents of the region for planting on private property.

Examples in Cincinnati and peer cities
- **San Francisco**
    - The City of San Francisco offers residents the opportunity to purchase carbon offsets. The funds collected are used to help support a variety of sustainability initiatives, ranging from solar energy to alternative fuel projects. https://sfenvironment.org/news/press-release/mayor-unveils-first-ever-local-carbon-offset-program

Who will be taking the leading roles on this project?
- The Parks Foundation will take the lead on implementation of this program.

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[117] (Badiou, McDougal, Pennock, & Clark, 2011)

Who is the target audience?
- Residents of Cincinnati
- Businesses
- City Parks Department

What is the City of Cincinnati's role in implementation?

The City will partner with the Parks Foundation and work to implement.

Is it Feasible?
- Feasibility: Medium
  - It is moderately feasible. While relatively simple in concept, the measure would require the support of the Parks Foundation, administrative support, and sufficient interest from residents to fund the program. There are few examples of successful carbon offset programs.

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio 5 yrs.
Minimal (To donors)	$50,000/year (To City of Cincinnati)	

The cost to implement this program will be funded by donations from individuals and businesses purchasing offsets. The San Francisco Carbon Fund will raise $150,000 in 2018. Scaled by population, Cincinnati could expect $50,000/year when the program matures. This represents a low-risk opportunity for the City.

Keys to Equity:
- Focus tree plantings in areas with the lowest tree canopies which tend to be the most disadvantaged areas
- Target areas that suffer from the Urban Heat Island effect
- Educate residents on how trees can lower surrounding temperatures as well as save on air conditioning costs

Timeline for Implementation
This recommendation will take 1 to 3 years to implement

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2035	2050
0 $mtCO_2$	59 $mtCO_2$	111 $mtCO_2$

The CO_2 sequestration rate for urban trees in Ohio is 0.248 kg C per m^2 per year (Nowak et al., 2013). The goal of the carbon offset program is to plant 500 trees per year. In 2035, this would result in a net uptake of 59 mtCO$_2$. In 2050, this would remove 111 mtCO$_2$ from the atmosphere.[118]

5. Decrease the acreage of mowed grass and replace with bushes and trees.

What is it and why is it important to Cincinnati?

Lawns have been called green deserts because of their lack of ecological value. Lawns have very low plant species diversity, provide habitat for very few insects and animals, and allow very little stormwater to infiltrate into the ground. The City of Cincinnati will work with the Parks Department, Public Services, and other organizations to decrease the area of mowed grass and increase the number of bushes and trees throughout the city. Replacing this mowed grass with trees and bushes provides habitat for wildlife and improves the pollination paths for insects. It will also help reduce flood risk during large rain events, sequester carbon, improve air quality, and reduce urban heat islands. Lawn mowers consume fossil fuels, emit CO_2, and emit conventional air pollutants.

Encouraging households to plant more trees and bushes is one way to reduce the amount of mowed grass. The City will contribute by planting more trees and bushes in parks, in curb strips, and throughout the city. Areas with higher acreages of mowed lawn will be targeted in this effort. These areas will experience less flooding and lower temperatures once the trees and bushes are developed because they will soak up the water and shade the ground from receiving sun all day. Trees put in business parks and other commercial areas will benefit these buildings by shading parts of the building throughout the day, which in turn lowers the buildings energy consumption and ultimately the energy costs.

Reducing the acreage of mowed grass will decrease the environmental and economic costs of yard care. Most mowers use gasoline or diesel and produce far more pollution than larger car engines because they lack a car's sophisticated exhaust system.

This recommendation will address equity by identifying and prioritizing neighborhoods that have higher ground temperatures, are more susceptible to flooding, and have a low percent of tree canopy coverage. Education will be incorporated for the public to understand the benefits of less grass for the environment and for the resident who saves money.

Who will be taking the leading roles on this project?

Who is the target audience?
- City of Cincinnati
- Public Services
- Department of Transportation and Engineering
- Parks

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[118] (Nowak, Greenfield, Hoehn, & Lapoint, 2013)

What is the City of Cincinnati's role in implementation?

Is it Feasible?
- Feasibility: Easy
  - This recommendation is highly feasible.

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio 5 year
$2,875 per acre (To City of Cincinnati)	$460 per acre annually (To City of Cincinnati)	1.25:1 (6.25-year payback)

The cost to install trees, shrubs and other native foliage depends on the exact mix of foliage chosen. It takes about 25 large trees to provide canopy coverage for 1 acre of land. Assuming a cost of $115 per tree for both the tree and logistics for a smaller sized 5' tree, it would require $2,875 per acre to convert from grass to trees. Benefits would be most immediately realized in the reduction of costs related to mowing and lawn maintenance. According to a Cost/Benefit Analysis completed at Xavier University the cost of these services is roughly $460 per acre. This does not quantify the monetary benefits that might be derived from enhanced property values, expanded canopy and carbon sequestration. To factor in these would greatly increase the benefits.

Keys to Equity
- Implementation in all neighborhoods of Cincinnati.
- Regular upkeep of plantings.

Timeline for Implementation
- This can be implemented in 1 to 3 years.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
0.5 mtCO$_2$e	2.5 mtCO$_2$e	30.6 mtCO$_2$e

An analysis of lawn maintenance indicates use of 54 gallons of gasoline per acre of lawn per year. It is assumed that the City can replace 1 acre of lawn with bushes and trees each year. There are 17.7 pounds of CO$_2$ released per gallon of gasoline used mowing.[119][120]

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[119] (Perry, n.d.)
[120] (Becker, 2017)

6. Increase the amount of storm water holding capacity using green infrastructure and natural systems.

What is it and why is it important to Cincinnati?

Green stormwater management can benefit the City by reducing stormwater damage, increasing green spaces throughout the City, and decreasing expenditures on stormwater infrastructure. Through methods such as pocket parks, rain gardens, and bioswales, stormwater can be absorbed into the ground and filtered of pollutants so they do not have a harmful effect on the waterways that they flow into. Using rain barrels to catch storm water can allow residents to consume less water when gardening or other outdoor activities.

Commercial buildings can also use stormwater capturing systems to reduce potable water use as well as reduce heating and cooling costs. Incorporating green roofs on buildings allows them to have a garden on the roof that captures and reuses rainwater as well as helps cool buildings during the summer months and heat them during the winter months.

The City will enable and encourage natural stormwater management by identifying and removing regulatory obstacles, and by creating appropriate incentives. As more permeable surfaces are incorporated into the City's landscapes, rainwater will naturally filter itself into the ground reducing the amount of flooding. These structures could also pair with a pocket park to send water from storms into the parks so that neighborhoods and families could benefit from the park while also capturing the stormwater.

Case Study: Smale Park

Image from http://www.cincinnatiparks.com/smale-riverfront-park/

Smale Park sits south of 2nd avenue along the Ohio River and offers a scenic 1000-foot-long riverfront promenade. It connects to many trails, including the Ohio River Trail. When complete, the Ohio River Trail will provide a link from western Indiana to east of Cincinnati through Smale park. The park also provides connection to the Little Miami River Trail which will one day connect Cincinnati to Cleveland. Inside the park there are many sustainability features including twelve acres of pervious lawn, a walking meditation 'labyrinth' and a tree grove. Geothermal pumps heat and cool an integrated bicycle center, locker room facility, and a restaurant pavilion, with a nearby brewery. The park generates electricity from an on-site solar array. These combine to provide a healthy, sustainable and breathable park that captures the scenic banks along the Ohio River for members of the tri-state region to enjoy.

Examples in Cincinnati and peer cities

- **Cincinnati, OH**
    - The Metropolitan Sewer District is in the process of "daylighting" the Lick Run watershed, a project that will eliminate nearly 400 million gallons of CSOs annually and ensure that 88% of the flows during a typical year of rain will either reach the Mill Creek treatment plant or be discharged as stormwater to the Mill Creek. http://www.projectgroundwork.org/lickrun/
    - The Cincinnati Zoo added large areas of enhanced turf/vegetation, storm sewer separation and redirection of rooftop surface runoff into a rainwater storage and reuse system. It is the Zoo's goal to generate zero site runoff during a 50-year storm event.
    - Cincinnati State has incorporated green infrastructure features on its campus. The estimated total annual volume of runoff removed in a typical year is more than 12 million gallons.
- **Columbus, OH**
    - Columbus has implemented 50 acres of green infrastructure upgrades to help mitigate the effects of stormwater and capture more before it pollutes waterways
    - https://www.columbus.gov/Templates/Detail.aspx?id=2147499893

- **Portland, OR**
    - Portland has implemented many green infrastructure upgrades that allow them to capture rain water and prevent street and home flooding
    - https://www.portlandoregon.gov/bes/44953

Who will be taking the leading roles on this project?

Who is the target audience?
- Commercial Building owners
- Residents

What is the City of Cincinnati's role in implementation?
The City will work with outside organizations to remove regulatory barriers to green infrastructure and create educational campaigns along with providing examples throughout the city of green infrastructure that has already been implemented

Is it Feasible?
- Feasibility: Easy
    - It is highly feasible because peer cities have implemented and Cincinnati has already begun to construct green infrastructure throughout the city. MSD and the Cincinnati Zoo have implemented green infrastructure projects.
    -

How much would it cost?

Cost per million gallons retained	Benefit per million gallons retained	Cost Benefit Ratio
$230,000 (To landowners)	$400,000 (To downstream landowners and ecosystem)	1:1.7
Cost per 1-acre park created	Benefit aggregate value per acre of park	Cost-Benefit Ratio 5 year
$150,000 (To City of Cincinnati)	$13,202/yr. (To public)	1:0.4 11-year break even

For the pocket park initiative, a similar project in St. Louis provides material and consultation to communities and estimates that each park, the largest of which are 2 acres, costs between $150-$600 thousand. Los Angeles commissioned a cost benefit analysis of stormwater retentions and enhanced property values and found that parks increase nearby resident parcel value by around 5% although some studies estimate higher.[121] LA found for every home within 500 feet of a park the increase in tax revenue due to enhanced property values was $322.65 and the value of stormwater infiltration in their 40,000 acres of parks was estimated to be worth roughly $200 per acre. Another $40 of value was attributed to their parks for pollutant removal capacity, per acre. LA was also able to determine tax revenue increases due to park tourism to be worth roughly $680 per acre and pinned the value of offset

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[121] (OneSTL, 2017)

medical expenses and increased recreational use to contribute another $12,000 per acre to the relative value of their park system.[122]

Keys to Equity:
- Implement in disadvantaged areas
- Conduct an assessment to determine areas that would benefit the most
- Provide jobs installing and maintaining green infrastructure to a wide variety of residents and companies throughout the City

Timeline for Implementation

This recommendation will take 3 to 4 years to implement but a few first steps include identifying areas to most effectively implement green technologies as well as determine which technologies are most beneficial in specific areas.

Greenhouse Gas Impacts

While there would be some greenhouse gas sequestration by the plants used in green infrastructure, the intent of this recommendation is to prevent stormwater runoff and damage.

7. Develop an Air Quality Action Plan.

What is it and why is it important to Cincinnati?

The City of Cincinnati will work with outside organizations to develop an Air Quality Action Plan to reduce emissions of pollutants on Air Quality Advisory days and throughout the year. The goal will be to reduce harms associated with air pollution, especially to people with special sensitivities as well as working to lower the asthma rate throughout Cincinnati. This action plan will implement reductions in air pollutants being emitted which can have negative effects on all residents of Cincinnati.

Implementing an Air Quality Action Plan will allow the City to hold itself and companies accountable for pollution. The Plan will help citizens to reduce their contributions to poor air quality by shifting when they mow the lawn, refuel their cars, and do other ozone-generating tasks. Providing residents with trackable air quality data through social media will alert residents who are sensitive to poor air quality so they can help prevent asthma flare ups.

An Air Quality Action plan will be most effective if residents in disadvantaged areas who are disproportionately affected by asthma have access to air quality data daily. These data can inform actions that will prevent harmful flare ups for kids and adults who can prevent it by limiting their time outdoors.

Examples in Cincinnati and peer cities
- **Madison, WI**
    - Madison is working to improve overall air quality by reducing their reliance on coal and creating policies and programs to limit industrial companies from polluting.

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[122] (The Trust for Public Land, 2017)

- https://www.publichealthmdc.com/environmental/air/outdoor.cfm
- **Denver, CO**
  - Denver is striving to meet the national Air Quality standards to provide the best quality for all residents
  - https://www.denvergov.org/content/denvergov/en/environmental-health/environmental-quality/air-quality.html

Who will be taking the leading roles on this project?

Who is the target audience?
- Emitters of air pollution
- Residents
- Individuals sensitive to air pollution

What is the City of Cincinnati's role in implementation?

- The City will own this recommendation and work to collaborate with outside organizations while creating the plan

Is it Feasible?
- Feasibility: Easy
  - This recommendation is feasible because other peer cities have implemented similar plans

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio
Nominal (To City of Cincinnati)	TBD (To public)	TBD

The costs related to development of an Air Quality Action Plan are nominal administrative costs. This recommendation can be completed by the Office of Environment and Sustainability in collaboration with local and regional partners.

Keys to Equity
- Provide all residents, including disadvantaged residents, access to the plan and the real-time data
- Educate residents on what to do when air quality is poor to help prevent health flare ups

Timeline for Implementation?
- This recommendation will take 1 to 2 years to implement

Greenhouse Gas Impact

This recommendation is intended to improve air quality in the region. Greenhouse gas reductions associated with this recommendation will be nominal.

8. Conduct Biodiversity assessment for Cincinnati.

What is it and why is it important to Cincinnati?

Hamilton County is home to 9 federal endangered species and more than 30 State of Ohio endangered species. Which ones can be found in Cincinnati? The City of Cincinnati will work with outside organizations to conduct a Biodiversity Assessment. This assessment will allow the City to better understand what locations merit special protection and to target conservation resources to where they will do the most good. This will allow the City to develop plans to provide protection to certain areas that contain natural communities that are at risk.

The City will use this assessment when looking at development plans to determine if there are species and natural communities that merit special protection on certain pieces of land. The results of the assessment will allow the City as well as outside organizations to implement conservation efforts and plans to ensure that our natural systems are functioning properly.

This assessment will help promote equity throughout the city by providing all residents with equal opportunities to enjoy the same ecosystems no matter where they reside. Considering the natural ecosystems in different parts of the city, many disadvantaged neighborhoods have vulnerable ecosystems. This assessment will motivate conservation efforts for such neighborhoods.

Examples in Cincinnati and peer cities
- **Urban Biodiversity Inventory Framework:** The City of St. Louis led an effort to create an Urban Biodiversity Inventory Framework that provides a methodology communities can use to guide their efforts to track and restore urban biodiversity. Products include: 1) the Urban Biodiversity Inventory Framework; 2) Protocol Sheets (plants, butterflies, birds, beetles, and bees), and 3) a guide to using the web-based tool
- https://www.usdn.org/uploads/cms/documents/urbanbiodiversity.zip

Who will be taking the leading roles on this project?

Who is the target audience?
- Endangered and threatened species.
- Unique ecological niches.

What is the City of Cincinnati's role in implementation?
- The City will own this recommendation and work with outside partners to create an assessment

Is it Feasible?
- Feasibility: Medium

- o It is very feasible however a new model must be created due to no peer cities implementing a similar plan

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio
TBD (To City of Cincinnati)	TBD (To public)	TBD

Conducting a biodiversity assessment is a cost-effective method to gain important knowledge of the natural systems within the City of Cincinnati, and how it relates to our greater region. The cost of the assessment is to be determined.

Keys to Equity
- Target disadvantaged neighborhoods that have more vulnerable natural systems
- Educate residents on importance of protecting these natural systems and the biodiversity throughout them

Timeline for Implementation?
- This recommendation will take 2 to 3 years to implement. The first steps will be obtaining a cost estimate and securing funds to hire a consultant.

Greenhouse Gas Impact

This recommendation is intended to gauge the health of our urban ecosystem. It will not have an impact on greenhouse gas emissions.

Photo from Enquirer

RESILIENCE

Preparing Cincinnati to persist, recover and thrive as our climate changes

While sustainability is focused on how we can live within our ecological capacity, resilience looks at how we can adapt to address existing and potential disruptions to our way of life. Resilience thinking focuses on how we can better be prepared for acute shocks (like intense rain or heat events) and chronic stresses (like economic and social inequities). It is about working systemically to mitigate impending risks and enhance our quality of life.

Cincinnati faces a variety of challenges that are common in cities today, including sewer overflows and flooding, childhood poverty, food deserts, and opioid abuse. These types of challenges require innovative strategies and collaborative initiatives across City departments and sectors – employing an ongoing process of continuous improvement to make our infrastructure more resilient, find better ways to provide basic services, and reduce public health disparities.

In May of 2017 the City created an Extreme Weather Task Force comprised of representatives from various municipal departments. This group identified risks, proposed recommendations, and developed

cross-departmental projects. Among its first initiatives are the creation of a neighborhood vulnerability assessment and a heat-island map. Cincinnati has been selected by Arup and the Rockefeller Foundation to become a "first-user city" for their City Resilience Index (CRI) program. The CRI is a tool designed to measure a City's capacity to survive, adapt, and thrive in the face of chronic and acute stresses.

Building upon this foundation, our Task Team identified opportunities for an informational resource hub and alert system to empower and connect residents, a green jobs program to implement local solutions, and regulations and incentives for greener development and public maintenance projects. You will see many of our suggestions incorporated into the recommendations throughout this plan.

Resilient systems are often decentralized and distributed. They have built-in redundancies, often at different scales. Therefore, it is important not only to improve public infrastructure, but to also empower residents and communities with tools that foster greater self-reliance, creativity, and cooperation in the face of potential crises. This is not just a top-down initiative – you and your neighbors play a vital role in building community resilience. Let's all work together to make Cincinnati an even better place to live, work, and play.

Charlie Gonzalez
Resilience Team Lead

Goals

1) NO INCREASE IN STORM OR HEAT RELATED FATALITIES.

- July 12-August 1, 1999: 18 deaths in Cincinnati due to hot/humid weather; CDC survey of 24 U.S. metropolitan areas indicated that Ohio recorded some of the highest rates for heat-related deaths during 1999 heat wave; Cincinnati reported 21 per million ((MMWR. 2000 Jun 2; 49(21):470-3)
- Between 1979-1997, annual average of 371 deaths per year attributable to excessive heat exposure in the US
  - 7046 deaths due to excessive heat exposure; 3010 due to weather conditions; 351 of man-made origin; 3683 of unspecified origin

  - Annual death rate due to weather conditions 2x higher for men than women, 3x higher for blacks than whites

2) NO INCREASE IN STORM DAMAGE REMEDIATION COSTS.

3) 50% DECREASE IN CHILDHOOD ASTHMA-RELATED HOSPITAL ADMISSIONS IN TARGET NEIGHBORHOODS. REDUCE DISPARITIES BETWEEN NEIGHBORHOODS.

Recommendations

Many of the recommendations of this plan are inter-related, and have multiple benefits. For additional recommendations related to Resilience, please see:

- *Built Environment #9: Require or incentivize Low Impact Development for new developments and infrastructure.*
- *Energy #8: Increase battery storage capacity.*
- *Food #6: Support/Promote the work of organizations that increase accessibility, affordability, and consumption of healthful foods for vulnerable populations.*

- *Transportation #6: Improve neighborhood walkability, by improving sidewalk connectivity and pedestrian safety, especially in low-income neighborhoods.*
- *Transportation #9: Increase interconnectivity and cohesion within multimodal transportation options.*

1. Launch campaign to reduce childhood asthma rates in Cincinnati.

What is it and why is it important to Cincinnati?

Ongoing air quality issues, increased frequency of heat events, and rising allergy rates all contribute to Cincinnati's asthma rates. Reducing childhood asthma will be important to improving the City's resilience (and improving the quality of life for residents). The City of Cincinnati will support existing campaigns to address the issue of childhood asthma rates, including efforts from Children's Hospital and other partners. Cincinnati has neighborhoods with childhood asthma rates that are 10 times higher than some other areas. This campaign will target those neighborhoods in the city which are disproportionately affected by asthma. The campaign will focus on improvements to air quality measurements and warnings, education to all residents about how to minimize the effects of asthma, and the reduction of irritants that cause asthma symptoms in both indoor and outdoor air.

Education will be fundamental to reducing the asthma rate. Residents will be informed of ways to manage their asthma by taking medicine on a regular basis and avoiding activities that cause these symptoms to flare up. Improving the condition of the housing stock and adding home inspections for indoor sources of air pollution (leaky roofs, wet basements), air circulation and air filters will help prevent irritants from entering homes causing symptoms to arise. Reducing the amount of pollutants from motor vehicles and coal-fired power plants and adding trees to filter the air in targeted locations will reduce the irritants that can cause symptoms when a child is outside.

Expanding on this campaign will help children who currently have asthma and will help prevent additional children from developing asthma. While this is targeted at childhood asthma, it will have benefits for anyone with asthma. Addressing asthma will allow children to live healthier, more active lives without the worry of aggravating their symptoms.

Examples in Cincinnati and peer cities.
- **Cincinnati Children's Hospital, Division of Asthma Research**
    - Cincinnati Children's Asthma research team works to improve the health of children who suffer from asthma by conducting research and providing methods of treatment
    - https://www.cincinnatichildrens.org/research/divisions/a/asthma
- **Louisville Department of Public Health and Wellness**
    - The Department created a program that aims to improve the asthma outcomes for all residents in the metro area by working with local stakeholders and pediatricians to conduct research and come up with effective treatment methods
    - https://louisvilleky.gov/sites/default/files/health_and_wellness/about_us/fy16lmphwannualreport.pdf

Who will be taking the leading roles on this project?

- Cincinnati Health Department

- Cincinnati Children's Hospital
- OES

Who is the target audience?

- Local health professionals
- Low income neighborhoods with high asthma rates

What is the City of Cincinnati's role in implementation?

- The City Health Department has teamed with Children's Hospital to form CLEAR (Coalition to Lessen Environmental Asthma Risks) and reduce childhood asthma. The City will help to identify areas that are prone to higher asthma rates, aid in creating campaign materials for implementing certain programs, and work to lessen indoor and outdoor pollutant concentrations.

Is it Feasible?

- Feasibility: Medium
    - There are existing programs and campaigns in place to address asthma in the city.

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio
$1.7 million (To City of Cincinnati)	$13.1 million/year (To families and healthcare providers)	1:7.6

The National Institute of Health (NIH) estimated in 2017 that the mean cost per asthma patient per year is $3,100[123]. Cincinnati Children's estimates that 13% of children in Cincinnati have asthma which equals about 8,450 children with asthma. Based on a study of asthma in Hamilton County there are 5.1 admissions per 1000 children [2] [124](862 child asthma admissions among 167,653 children). Based on the NIH figure we can expect that the cost of treatment for these children is about $26.2 million per year. To achieve a 50% decrease in childhood asthma admissions could yield $13.1 million in savings, annually.

To provide Asthma Action plans to the 8,450 children of Cincinnati with asthma would require primary care appointments with a medical professional. Costs for appointments would vary, making a subsidy difficult to quantify. A study of primary care costs at Johns Hopkins reports the average visit costs $49 for privately insured patients and $200 for uninsured[125]. Costs to subsidize visits for 8,450 children range from $414,050 to $1.7 million. Asthma action plans typically remain relevant to patients for a few years,

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[123] (Nunes, Pereira, & Morais-Almeida, 2017)

[124] (Beck, et al., 2013)

[125] (City of Cincinnati, 2017)

so there will not be a need to re-evaluate every year. A key component to these is also continued management. The City and Children's should work with local schools to ensure these plans are closely monitored and can have their strongest effect.[126]

Keys to Equity:
- Target low income neighborhoods that have the highest rates of childhood asthma
- Provide subsidies for medicine needed to treat symptoms
- Address asthma triggers in low income homes.
- Plant trees in high asthma neighborhoods

Timeline for Implementation
- This recommendation can be implemented in 1 to 2 years based on programs and campaigns that are already underway. The City will work with partner organizations to educate disproportionately affected areas on steps to take to reduce the amount of asthma flare ups through programming in the communities throughout the first two years.
- Improving outdoor air quality will take longer.

Greenhouse Gas Impact

This recommendation is intended to improve the health and resiliency of Cincinnati residents. The greenhouse gas implications will be nominal.

2. Develop multilingual communication network for disseminating risks and recommendations in the event of emergency (e.g. Rave Alert).

What is it and why is it important to Cincinnati?

The City of Cincinnati has partnered with Rave Alert to establish a mass communication system that allows residents to sign up for alerts in the case of natural disasters, public safety, road closures, and more. This system allows Hamilton County and the City of Cincinnati to easily transmit messages via text, email, and voice. This system can be used to warn residents when extreme weather approaches, to inform residents of important resources such as emergency shelters, and to provide instructions on how to minimize damage and speed recovery.

With Rave Alert in place, education of residents and full implementation of the system are the next steps to becoming more prepared in the case of emergencies. The City of Cincinnati will work to utilize more communication channels to reach every resident in their preferred way. These channels could include postcards in the mailbox of residents who do not use technology. The City will work to

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[126] (Johns Hopkins Bloomberg School of Public Health, 2015)

incorporate foreign language options for automated messaging, so that each resident can be contacted in their preferred language. Providing recommendations to residents before disasters occur will allow them to become more prepared once a disaster takes place. The City will work to inform residents of the availability and location of resources in the event of emergency, including locations that will serve as heating and cooling centers, and food banks. Developing a communication system will allow residents to take action before events occur, helping minimize financial and health damages.

Examples in Cincinnati and peer cities.
- **Rave Alert- Cincinnati**
  - Cincinnati has tapped into a communication network that allows them to send out texts, emails and voice messages to those who opt-in about emergency and non-emergency situations.
  - https://www.ravemobilesafety.com/products/rave-alert-product/
- **Indianapolis, IN**
  - Indianapolis has upgraded their current system to allow for more connection towers and to supply back up power when the grid goes down.
  - http://www.govtech.com/policy-management/Indianapolis-Announces-Upgrade-of-Public-Safety.html?topic=117680

Who will be taking the leading roles on this project?
- City of Cincinnati – Enterprise Technology Systems

Who is the target audience?
- The Public
- Non-English-speaking residents

What is the City of Cincinnati's role in implementation?
- The City will own this recommendation and will partner with the County and work with an outside organization to create a multilingual system that is accessible by all.

Is it Feasible?
- Feasibility: Easy
  - The City has already subscribed to the Rave Alert system and is working to develop a communication strategy.

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio
$54,000 Annually (To City of Cincinnati)	NA	NA

Rave Alert is a solution which can quickly be used to send a message over text, email, voice, IPAWS-OPEN, WebEOC, and digital signage at the same time. It enables targeted communications which can be used to transmit information in multiple languages as well. This technology has been very useful in disasters on similar scale to what the City of Cincinnati would require. The cost to the City of Cincinnati

for the recently purchased Rave Alert platform is $54,000, annually. It provides the City the benefit of instant, mass communication and does so on a variety of platforms.

Keys to Equity
- Allow for multi-lingual residents to opt for their native language when choosing a communication method.
- Provide low-tech options for those who do not have phones or computers.

Timeline for Implementation
- This recommendation is already starting to be implemented and will be expanded within the next 1 to 2 years to be available for all residents, no matter what language or communication method.

Greenhouse Gas Impacts

This recommendation is intended to aid in risk reduction and emergency communication. The greenhouse gas impact will be minimal.

3. Conduct a Neighborhood Vulnerability Assessment.

What is it and why is it important to Cincinnati?

A Neighborhood Vulnerability Assessment (NVA) is an important tool for targeting resilience efforts. A Neighborhood Vulnerability Assessment has been initiated by the Office of Environment and Sustainability. When complete, residents will be able to view this document through the City's website. The NVA will allow residents to see where their neighborhood has strengths and where there are weaknesses. The NVA will include categories such as tree canopy coverage, landslide threat, education level, and many others. The result will be a set of priorities to improve resilience in each Cincinnati neighborhood. This NVA will help to address equity by identifying services that are tailored to individual

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Case Study: Extreme Weather Task Force

After experiencing three '100-year rainstorms' in a year, the Cincinnati Mayor and City Manager's office established the Extreme Weather Task Force, combining the expertise of nine different departments. Among their chief concerns; to mitigate landslide, flooding, property and infrastructure damage so that the City can avoid costly repairs before the damage is done. The Extreme Weather Task Force is partnering with the City Office of Environment and Sustainability to enhance the 2018 Green Cincinnati Plan, to complete a City Resilience Index and partner with Hamilton County on the 2018 Hamilton County All-Hazards Mitigation Plan. It is the intention of the Extreme Weather Task Force, along with partner organizations and departments to enhance the climate resilience of the region for the extended future.

neighborhoods. Different neighborhoods will receive different recommendations on how to improve because they will be lacking in different areas. Neighborhood demographics are among the criteria used to help implement solutions that are best for the specific neighborhood.

Examples in Cincinnati and peer cities
- **Austin, TX**
  - Austin created a climate change vulnerability assessment that spotlights the city's most vulnerable areas for certain types of natural disasters.
  - http://austintexas.gov/sites/default/files/files/CAMPO_Extreme_Weather_Vulnerability_Assessment_FINAL.pdf
- **Boston, MA**
  - Boston analyzed many climate change disasters and considered what areas would suffer the most and how to respond to those.
  - https://www.boston.gov/sites/default/files/04_climate_ready_boston_digital_climatevulnerabilityassessment.pdf

Who will be taking the leading roles on this project?
- Office of Environment and Sustainability
- Office of Performance and Data Analytics
- Xavier University

Who is the target audience?
- Neighborhoods

What is the City of Cincinnati's role in implementation?
- The City will own this recommendation, working with community partners to identify data sources.

Is it Feasible?
- Feasibility: Easy
  - The NVA is currently in progress

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio
Nominal (To City of Cincinnati)	TBD	TBD

- This recommendation is being accomplished using existing resources in the Office of Environment and Sustainability with support from regional partners.

Keys to Equity
- Use the NVA to target resources and response efforts to the neighborhoods that need them the most.
- Provide recommendations on how each neighborhood can improve.
- Educate residents on what each category is measuring and what the score means.

Timeline for Implementation
- This recommendation can be implemented in 1 to 2 years because a large portion of the data has been collected already. Once the data is collected, it will be analyzed and put together in a user-friendly document that will be accessible to the public.

Greenhouse Gas Impact

This recommendation is intended to help understand the risks faced by different communities. The greenhouse gas impact will be minimal.

4. Climate Haven – Leverage climate resilience to attract new business and residents.

What is it and why is it important to Cincinnati?

An estimated 13 million residents of the United States may be forced to move due to rising sea levels by the end of this century[127]. Hundreds of thousands have already moved in the wake of significant storms. Destinations for these individuals may be limited because: 1) Some inland locations are already at or near their growth limits due to water shortages and other constraints; 2) Some inland locations will experience their own stresses or disruptions due to changing weather patterns; and 3) Some inland locations may choose not to welcome those seeking to relocate. As weather related disasters increase in frequency and severity across the country and the world, there will be an increasing need for housing and services. While Cincinnati will experience climate impacts, we will not be significantly impacted by sea level rise, coastal storms, droughts, or wildfires. Moody's recently ranked Ohio #3 on the list of states least threatened by climate change[128]. As such, Cincinnati is well suited to serve as a Climate Haven, providing opportunities and services for those seeking to relocate as the climate changes.

Many businesses seek to ensure continuity of operations, and may consider relocating from disaster-prone locations to relatively safe locations like Cincinnati. This will provide economic opportunities if Cincinnati is prepared to market itself to these businesses.

The City of Cincinnati will work with many outside organizations to prepare for its role as a climate haven. Cincinnati will be viewed as a resilient area when extreme weather events occur and people cannot return to their homes for an extended amount of time. Being located outside the likely disaster areas but within reasonable driving distance makes Cincinnati an attractive location. Cincinnati will also cultivate its reputation as a safe location for risk averse businesses.

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[127] (Hauer, 2017)
[128] (Moody's Investor Service, 2017)

The City will need to prepare for increased population by having enough food and shelter when individuals relocate. Outside organizations will work together to make sure food reserves are in place. Homeless shelters and shelter homes will need to have enough beds to accommodate a large spike in use. The City will work to provide more affordable housing individuals that need it for short-term use or that decide to make Cincinnati their new home. The City should expect to be compensated for the hospitality it provides. FEMA and private insurance companies are ultimately responsible for costs related to disasters.

This increase in affordable housing will help to address equity because while some of it can be used for individuals that choose to relocate to Cincinnati, current residents with budget constraints will also be able to rent these homes. Increased food reserves and homeless shelters will also help disadvantaged residents find shelter and a meal.

Examples in Cincinnati and peer cities
- **Duluth, MN**
    - Duluth is working to prepare its city by increasing housing that will help the city be more resilient not only to providing housing for current residents but also for new arrivals from other disaster-prone areas of the country.

Who will be taking the leading roles on this project?

Who is the target audience?
- Aid organizations
- FEMA
- Residents
- Businesses

What is the City of Cincinnati's role in implementation?
- The City will work with outside organizations to provide necessary programs and resources to aid those who come to Cincinnati, and to recruit new businesses.

Is it Feasible?
- Feasibility: Moderate
    - Peer cities have been able to create plans to address a large population surge.
    - Receiving individuals who are relocating requires significant preparation.

How much would it cost?

Cost (100 Families)	Benefit	Cost-Benefit Ratio
$600,000 (To City of Cincinnati and Housing	$600,000 (To City of	1:1

Authorities)	Cincinnati)	

A typical rental housing unit in Cincinnati costs about $500/month, or $6,000 per year. To rent housing for 100 families for a year would cost about $600,000. After a disaster, individuals seeking to move are likely to be receiving relocation assistance from either FEMA or their private insurance company. Therefore, reasonable costs for welcoming those who relocate are likely to be reimbursed from non-Cincinnati sources. These figures don't include food or other expenses, and don't include assets and earnings of the relocated families.

Cincinnati has a network of housing assistance programs which can be leveraged to assist if outside resources are not adequate. The Office of Community and Economic Development provide down payment assistance, foreclosure prevention, educational tools and offer legal assistance to low income renters. The Office has allocated $788,350 to its housing division in the FY 2018 operating budget[129]. The Cincinnati Metropolitan Housing Authority offers escrow programs tied to their education programs to encourage family self-sufficiency. Cincinnati also has faith based organizations providing housing assistance. Catholic Charities of Southwestern Ohio announced a goal to welcome 450 persons to the Cincinnati region in FY 2017, many coming together as families[130]. If the average family size is five, they would require 90 residences. While the individuals welcomed by Catholic Charities are typically not those relocating post-natural disaster, this shows that 100 families per year is a reasonable number for Cincinnati to absorb.

There are options which the City can use to attract businesses relocating from disaster prone areas. There are also many benefits to this policy. The opportunity for growth by welcoming new residents and businesses is likely to increase the base for tax revenues and foster growth in the individual neighborhoods of Cincinnati.

Keys to Equity
- Continue to provide low-income housing to current residents.
- Create jobs for both current residents and potential residents who are disadvantaged.
- Educate residents on ways to assist those who have relocated.

Timeline for Implementation
- This recommendation will take 1 to 2 years to implement. First steps could include identifying areas where supplemental housing could be built to house refugees as well as developing plans to provide jobs and resources for a population surge.

Greenhouse Gas Implications

This recommendation is intended to help host new residents. The greenhouse gas impact will be minimal.

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[129] (City of Cincinnati, 2017)
[130] (Curnutte, 2017)

5. Encourage onsite stormwater retention and infiltration and discourage runoff by restructuring sewer and/or stormwater fee.

What is it and why is it important to Cincinnati?

Runoff during storm events increases the amount of water entering the sewer system, which can lead to sewer backups, flash flooding, and sewer overflows. Permeable surfaces allow water to flow through them and into the ground, reducing the burden on the sewer system.

Cincinnati's Sewer District (MSD) is funded by a charge on each water bill that is a fixed percentage of the water bill. This charge is unrelated to the amount of stormwater generated by a property and gives a landowner no motivation to manage stormwater where it falls. Stormwater fees are a function of the size and use of the property and are unaffected by stormwater retention efforts. Cincinnati will shift to a sewer or stormwater fee based on each property's impervious surface, or the amount of runoff leaving the property. This will encourage decentralized stormwater solutions.

The City's Planning Department and Building and Inspection Department will work with other City departments to encourage permeable surfaces both privately and publicly when appropriate. The City has codes in place that make it necessary for many buildings to provide parking, and for parking lots to be paved, which contributes to large amounts of flooding. By reducing impermeable surfaces, land owners can spend less money on paving costs while also reducing the flooding that takes place in the area. Incentivizing permeable surfaces will help customers reduce the amount of fees they pay for contributing to stormwater runoff.

Providing incentives to increase the amount of permeable surfaces throughout the city will help reduce the costs for everyone, especially those who struggle to pay utility bills. By reducing paved areas, the City can minimize its costs to maintain parking lots and roads and can put this money into other public projects.

To inform decision making, the City should establish a method for measuring pervious and impervious surfaces.

Examples in Cincinnati and peer cities
- **Madison, WI**
  - Madison is working to educate residents on how they can mitigate stormwater runoff as well as provide details on how to get stormwater credits.
  - https://olw-lwrd.countyofdane.com/Get-Involved/Do-Your-Part

Who will be taking the leading roles on this project?

Who is the target audience?
- Commercial land owners
- Residential land owners

What is the City of Cincinnati's role in implementation?
- The City will own this recommendation and create incentives for stormwater management by commercial and residential land owners.

Is it Feasible?
- Feasibility: Easy
  - Other cities have similar incentives programs

How much would it cost?

Costs per gallon	Benefits per gallon	Cost-Benefit Ratio
$0.23 (To MSD)	$0.17 (Reduced Costs to MSD)	1:1.7

The cost of this recommendation is the administrative cost of designing, enacting and implementing a new fee structure. The benefit is the avoided cost of centralized wastewater management infrastructure which is unnecessary because of decentralized stormwater structures.[131]

Keys to Equity
- Educate residents in all neighborhoods including disadvantaged residents.
- Provide financing options so that all residents can include green technologies on their properties.
- Ensure that sewer rates are equitable.

Timeline for Implementation?
- This recommendation will take 1 to 2 years to implement.

Greenhouse Gas Impact

This recommendation is intended to help control stormwater runoff. The greenhouse gas implications are minimal.

6. Conduct an Urban Heat Island Assessment.

What is it and why is it important to Cincinnati?

The City of Cincinnati will work with community partners to create an Urban Heat Island (UHI) Map. Extreme heat is the leading cause of fatalities and hospitalizations among all weather-related disasters. An Urban Heat Island Map identifies areas that tend to be hotter than other areas throughout the city. This can be due to a lack of tree canopy coverage, high levels of impermeable surfaces, and other factors.

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[131] (City of Cincinnati, 2017)

The map will be used to target solutions to reduce the excessive temperatures. The map will also be used to identify and assist individuals who are most vulnerable to extreme heat.

This recommendation will address equity by providing methods of cooling to residents who are most affected. Possible implementation strategies that will come out of this including increasing tree canopy coverages, reducing the amount of impermeable surfaces, increasing the amount of green space, and adding cooling centers in the designated areas. Neighborhoods with heat islands and unairconditioned residences will be targeted for "caring networks", where vulnerable individuals are identified and monitored to provide assistance when needed.

Examples in Cincinnati and peer cities
- **Madison, WI**
    - Madison has worked to identify all areas that suffer from the urban heat island effect and are implementing methods to reduce this effect such as grass islands in parking lots that help absorb water and cool the surrounding area.
    - https://www.wiscontext.org/tackling-urban-heat-islands-goes-beyond-big-city

Who will be taking the leading roles on this project?
- Office of Environment and Sustainability
- OKI
- Miami University
- University of Cincinnati

Who is the target audience?
- Residents living in areas of increased heat
- Researchers

What is the City of Cincinnati's role in implementation?
- The City will work with community partners to create an urban heat island assessment.

Is it Feasible?
- Feasibility: Easy
- Obstacles:
    - Access to high-resolution data will be key to an informative urban heat island study.

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio
$27,500 (To City of Cincinnati)	TBD (To City of Cincinnati)	TBD

Assessments of urban heat islands can be performed in a variety of ways. Two peer cities, Columbus and

Louisville, have performed assessments of UHI. Both assessments were conducted primarily by partner institutions which used graduate students with academic expertise in the relevant fields likely reducing the costs of performing the assessment.

Benefits of an UHI assessment include greater cognizance of the vulnerability of the urban region to adverse heat and the effects on weather, and greater ability to target responses to the areas with the greatest needs. An assessment of the UHI does not mitigate the effects of extreme heat but gives us the knowledge to focus mitigation efforts. The benefits of an Urban Heat Island assessment are not quantifiable at this time.

Louisville completed a UHI study for $135,000 and funded it primarily through outside grants and university involvement. Cincinnati is a much smaller city in area. Estimating cost based on square miles, such a study could be conducted in Cincinnati for roughly $27,500.[132,133]

Keys to Equity:
- Educate residents on how to fight effects of the urban heat island.
- Conduct assessment in areas that contain low income and disadvantaged populations.
- Provide incentives for residents to implement recommendations that come out of the assessment.

Timeline for Implementation
- This recommendation will take about 1 year to implement.

Greenhouse Gas Impact

This recommendation is intended to collect information that will aid future resilience efforts. The greenhouse gas implications will be minimal.

7. Implement renewable backup power systems for areas of refuge and emergency facilities (911 center, recreation centers, hospitals).

What is it and why is it important to Cincinnati?

Extreme heat events cause more fatalities and hospitalizations than any other kind of extreme weather event[134]. The availability of air conditioning helps mitigate the risk of heat events, but not everyone has access to air-conditioned spaces. When a heat wave coincides with a power failure and air conditioning becomes unavailable, risks rise dramatically.

The City will work with outside organizations and emergency facilities to install renewable energy systems that can provide power in case of power outages. When emergency facilities can run on

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[132] (Voogt, 2017)
[133] (Mirzaei, 2015)
[134] (Center for Disease Control)

batteries charged from solar or wind power, they can perform their critical functions. The facilities that provide cooling centers, food, and shelter will need to be open even if the grid is down.

Having emergency power systems that recharge from renewable sources will help ensure everyone receives access to essential services during extreme events. Those in disadvantaged neighborhoods that rely on food banks or cooling centers in times of need will be able to access these facilities even if the grid is down.

Examples in Cincinnati and peer cities
- **Columbus, OH**
  - Columbus is working to generate power through renewable sources on facilities that are essential during power outages due to extreme weather events
  - http://www.ohiopowersolutions.com/how-solar-works/battery-backup
- **Pittsburgh, PA**
  - Pittsburgh has established microgrids that are powered by solar and wind power to prevent a total loss of power if the grid takes a hit
  - https://www.npr.org/2017/11/12/563276003/pittsburghs-microgrids-technology-could-lead-the-way-for-green-energy

Who will be taking the leading roles on this project?

Who is the target audience?
- Emergency facilities
- Residents

What is the City of Cincinnati's role in implementation?
- The City will own this recommendation but work with outside organizations to provide financing options that make it economically feasible.

Is it Feasible?
- Feasibility: Medium
  - Peer cities have implemented this and Cincinnati has already started to put solar on certain essential City facilities

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio (daily discharge/ 5 years)
$422/KWh (one time) (To City of Cincinnati)	$0.04/KWh/daily (To City of Cincinnati)	1:0.17 (28-year payback)

Hospitals consume roughly 31 KWh/sq. ft. of energy per year [1]. If each hospital has roughly 70,000 square feet each would likely demand roughly 6000 KWh per day. There are 20 hospitals in the

Draft 2018 Green Cincinnati Plan

Cincinnati area and an analysis of battery cost over the past decade estimates that the total price of storage (materials, shipping, installation and operation) is $422/KWh [2]. The analysis also found that price decreases 6-9% each time production is doubled, so scale factors in price. Based on these figures, to provide ample capacity to store enough electricity for a 70,000-square foot hospital for one day would cost roughly $2.5 million.

Grid scale batteries provide opportunity for economic profits, due to varying demands and prices. The simplest method is charging the batteries at off peak rates every night, and discharging, rather than buying on-peak power on a daily basis. If the generation portion of energy is $.02/KWh off peak, and $.06/KWh on peak, profits would be $.04/KWh of battery capacity. This can be done 260 times per year, if not more. The same 6000 KWh system can yield $240 a day in profit, $62,400 in a year (260 cycles). At current prices, these batteries would pay off in about 28 years if batteries charge and discharge once per weekday. This is a long payback period, but a reasonable way of providing important backup and stabilization to the grid and important facilities.[135][136]

Keys to Equity:
- Implement in areas where many residents rely on emergency services.
- Educate residents on where to go during emergencies and what services are available.

Timeline for Implementation
- This recommendation will take 3 to 5 years to implement. Early installations could be completed in 2 to 3 years. First steps include identifying emergency services that require power when the grid is down along with educating residents on where they should go in case of an extended power outage.

Greenhouse Gas Implications

This recommendation is intended to provide stability for critical City facilities. The emissions savings from installation of renewable energy is captured in other recommendations.

8. Educate the public to reduce harms from intense storms and heat waves.

What is it and why is it important to Cincinnati?

The City of Cincinnati will work with community partners to develop a campaign to help educate residents on how to prepare for and respond to intense storms and heatwaves. With proper preparation, health and property damage can be minimized allowing for a faster recovery.

Citizens should receive information on how to protect a home in a flood, how to deal with contaminated water, and how to respond to heat waves. Special strategies will be needed to reach non-English speakers, and those not on the internet. The overarching goal is to maximize the number of people who are prepared to act before, during, and after an emergency.

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[135] (OUC Business Energy Advisor, 2017)
[136] (Healy, 2017)

Examples in Cincinnati and peer cities

- **Madison, WI**
  - Madison is improving storm management by creating an educational campaign about how to mitigate stormwater runoff.
  - https://olw-lwrd.countyofdane.com/Management/Erosion-Control-and-Stormwater-Management
- **Columbus, OH**
  - Columbus is working to educate residents on the overall impacts of climate change and how residents can mitigate the impacts that come from storms, increased temperatures, and other weather events.
  - https://www.columbus.gov/getgreen/Key-Initiatives/

Who will be taking the leading roles on this project?

Who is the target audience?

- Residents

What is the City of Cincinnati's role in implementation?

- The City will provide assistance to outside organizations on putting together an educational campaign that provides mitigation efforts to reduce the impact of extreme weather events

Is it Feasible?

- Feasibility: Easy
  - Cincinnati can model programs after peer cities that have already implemented similar outreach efforts

How much would it cost?

Costs	Benefits	Cost Benefit Ratio
Nominal (To City of Cincinnati)	TBD (To City of Cincinnati)	TBD

Existing materials and unpaid media can be used to craft the message and communicate it to a lot of people at very low cost. Instructions on preparing for and responding to disasters is available from FEMA, health agencies, Red Cross, and others. Social media, public service announcements, and news articles can be used to push out the message.

Keys to Equity:

- Make sure campaign targets low income residents who are most vulnerable during extreme weather events.
- Make educational materials multi-lingual to reach all residents.

Timeline for Implementation

- This recommendation will take 1 year to implement with a first few steps including identifying measures that residents can take to minimize damages as well as determining which communities need more educational materials.

Greenhouse Gas Impact

This recommendation is intended to minimize health risk and property damage in the event of storm events. The greenhouse gas implications will be minimal.

9. Require occupied residential rental units to have one air-conditioned room.

What is it and why is it important to Cincinnati?

Working with the health department, the City will require all tenant-occupied rental residences in the city to have at least 1 air-conditioned room. Many houses and apartments throughout Cincinnati do not have air conditioners and rely on fans to keep cool during extreme heat events. This requirement will reduce the amount of heat related illnesses and deaths that occur due to the lack of access to air conditioning.

Many residences in Cincinnati do not have air conditioning because they were built at a time when air conditioning didn't exist. Today, room-sized air conditioners are inexpensive, easy to install, and available at many retail stores. The idea that people in Cincinnati die because a building owner failed to make such a small investment is unconscionable. By requiring all tenant occupied residences to have at least one air-conditioned room, residents will be able to go to that room during extreme heat events. Public cooling stations are insufficient because they are usually not open 24 hours, and many people have mobility issues that make it hard to get to a shelter.

Many of the residences that do not have air conditioning are in disadvantaged neighborhoods. A system may need to be put in place to subsidize the cost of an air conditioner when the building owner cannot afford one.

Examples in Cincinnati and peer cities

No examples of cities with programs like this were identified

Who will be taking the leading roles on this project?

Who is the target audience?
- Residents of older houses and apartments
- Landlords
- Low-income residents

What is the City of Cincinnati's role in implementation?

- The City will own this recommendation, enact the requirement, and work to find incentives to make air conditioners affordable for everyone

Is it Feasible?
- Feasibility: Medium
- Obstacles:
    - This recommendation has little precedent

How much would it cost?

Cost Total, Aggregated	Benefit offset value lost to 1 death	Cost-Benefit Ratio
$1,700,000 (To landlords)	$9,100,000 (To Community)	1:5.3

According to the U.S. Census Bureau's 2015 American Home Study, there are 18,900 residences in the Cincinnati Metro area that lack any air conditioning. Of these, 8,300 are tenant occupied units while 10,600 are owner occupied. While many of these are outside the City limits, the exact number outside the City is unknown.

A small, high efficiency window air conditioner can be purchased for about $100, and can be installed by a handyman with no special skills in under 2 hours. If we assume a total installed cost of $200, the total cost of this recommendation for tenant housing would be less than $1.7 million.

The cost to run a 5-amp, 5,000-Btu air conditioner over a 24-hour period is about $1.60. Running costs of AC units are also highly dependent on the insulation in the home. Once upfront costs are covered, the cost of saving a life may come down to a dollar or two per day.[137]

Benefits: Some might consider this mandate to be placing a disproportionate burden on the poorer communities but this recommendation is intended to protect residents of those communities from health risks. The danger of heat related illness (HRI) is a very serious threat to Cincinnati. The National Institute of Health found after studying a 2006 California heat wave that an increase in average temperatures by 10°F yielded a 393% increase in hospitalization for heat exposure, a 3% increase in ischemic stroke hospitalizations, and a 15% increase in acute renal failure hospitalizations[138]. The EPA places a statistical value on human life equivalent to $9.1 million (2017 USD)[139]. By this measure, if an air conditioner mandate saves even 1 life, the benefit to cost ratio would be at least 5.3:1.[140] A residential AC mandate is one of our best bets at preempting these costs.

Keys to Equity:
- Target landlords who should be responsible for ensuring an air conditioning unit in each unit they own.

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[137] (Home Advisor, 2017)
[138] (Schmeltz, 2016)
[139] (U.S. EPA, 2017)
[140] (Joe, 2016)

- Provide incentives to make it more affordable to own and operate the unit.
- Identify areas that disproportionately need AC more than others and try to buy in bulk to lower costs.

Timeline for Implementation

- This recommendation will take 2 to 3 years to implement. An air conditioner requirement could be adopted by the City within 1 year, with property owners having some time to comply.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2030
0 mtCO$_2$e	-448 mtCO$_2$e	-448 mtCO$_2$e

Adding air conditioners will increase CO$_2$ emissions. This recommendation will add 8,300 small window air conditioners. Each one will use .5kWh per hour, and will operate 6 hours per day, 20 days per year, on average.

10. Continue to develop and expand Metropolitan Sewer District's smart sewer SCADA system.

What is it and why is it important to Cincinnati?

Cincinnati has a system of combined sewers (sewers that carry a combination of wastewater and stormwater). During heavy storms, these sewers can be overwhelmed and bypass, discharging raw sewage into rivers and streams, or back up into people's homes. Metropolitan Sewer District (MSD) is under a court order to reduce bypasses and backups by 80%, and is spending billions of dollars to comply. MSD has begun using Smart Sewer techniques to reduce bypasses at a fraction of the cost of building larger storage and treatment facilities. MSD monitors rainfall, flow rates, and storage volumes throughout their system in real time, and opens and closes valves throughout the system to fully utilize existing capacity before allowing a bypass to occur. MSD is the first sewer system in the country to use real-time flow monitoring and controls to minimize storm releases.

MSD will continue to expand their smart sewer system to include additional locations for storage or redirection of flow. MSD has been working to minimize the amount of waste water that flows into rivers and creeks during rain storms. The initial Smart Sewer project has been estimated at saving over $10 million due to the reduction in overflow and has controlled hundreds of millions of gallons of sewage that would previously have polluted rivers and streams.

With future improvements on the way, MSD will use this technology to limit the amount of wastewater that goes into creeks, and the amount of water that backs up into the homes of residents. Upgrading the sewer system along with upgrading the technology to monitor it will allow for MSD to save millions when it comes to paying for damages to people's basements due to sewer backups.

Examples in Cincinnati and peer cities
- **Columbus, OH**
    - Columbus has been working to improve sewer systems in order to reduce their overflows by reducing the amount of combined sewer pipes they have within their city
    - https://www.columbus.gov/getgreen/Key-Initiatives/
- **South Bend, IN**
    - South Bend has implemented a similar "smart sewer system" to minimize the cost of reducing combined sewer overflow.
    - https://www.southbendin.gov/government/content/csonet

Who will be taking the leading roles on this project?
- Metropolitan Sewer District

Who is the target audience?
- Residents and Metropolitan Sewer District ratepayers

What is the City of Cincinnati's role in implementation?
- The City will partner with MSD and work to find affordable ways to manage stormwater by reducing combined sewer systems and implementing the smart sewer system throughout the entire city.

Is it Feasible?
- Feasibility: Medium
    - MSD has already begun using Smart Sewer technology with great success

How much would it cost?

Cost*	Benefit	Cost-Benefit Ratio
$0.01 per gallon of overflow reduced (To MSD)	$0.23 per gallon (next alternative) (To MSD)	1:23 (next closest)

*2017/2018 estimates

MSD reports that where applicable, smart sewers cost about $0.01/gallon of overflow volume reduced, as compared to about $0.23/gallon for green stormwater controls and about $0.40/gallon for larger pipes and storage tanks. Considering these options together, smart sewers are 95% less expensive than green stormwater controls which are the next cheapest alternative. South Bend Indiana recently invested in a similar technology, which is projected to reduce its Consent Decree spending by about 27 percent. MSD's smart sewer system has already helped to reduce overflows from its system by 400 million gallons.[141]

[141] (City of Cincinnati, 2017)

Keys to Equity:
- Target combined sewers in low income and disadvantaged areas.
- Educate residents on the importance of stormwater management and why the City needs to implement new technologies.

Timeline for Implementation
- This recommendation will take 4 to 5 years to implement. Initial steps include identifying areas that are affected the most by storm water and expanding the existing Smart Sewer utilization.

Greenhouse Gas Impact

This recommendation is intended to reduce risk of storm flooding. The greenhouse gas implication is minimal.

11. The City should develop an Environmental Justice program that identifies communities that are disproportionately burdened by pollution (and hazardous wastes), and acts to reduce or eliminate those burdens.

Cincinnati has a number of sites around the City that create environmental burdens for their surrounding communities. These burdens often affect low-income neighborhoods where the residents are unable to move away. The City of Cincinnati will develop an environmental justice program that identifies the communities suffering from environmental burdens and works with partners to lessen the burden.

Environmental hazards have been known to lead to negative health effects such as asthma and cancer. These health effects shorten the lifespan of residents living in affected neighborhoods. Children growing up in these neighborhoods are especially susceptible to health risks which can affect crucial stages of development. These effects can follow the children for their entire lives. The City of Cincinnati strives to provide equal opportunity and protection for all of its residents. Therefore, there is a need for an environmental justice program in the City.

Examples in Cincinnati and Peer Cities
- No examples of city environmental justice programs have been identified.

Which community partners could help with implementation?
- City of Cincinnati
- ECO
- Communities United for Action

Who is the target audience?
- Neighborhoods suffering from environmental burdens

What is the City of Cincinnati's role in implementation?

The City of Cincinnati will identify environmental burdens that affect disadvantaged neighborhoods, organize local partners, and work to lessen the burdens. The City will consider and address adverse health effects. The City will work to identify sources of funding, such as grants, when needed to address identified concerns.

Is it feasible?
- Feasibility: Hard
  - Eliminating and properly cleaning up environmental risks such as hazardous waste sites can be expensive.
- Obstacles:
  - Environmental burdens can originate from multiple sources (vehicles) or far away sources (power plants) or even from within the home (mold and mildew).

How much will it cost?

Cost	Benefit	Cost-Benefit Ratio: 8 year
$75,000 annual (To City of Cincinnati)	TBD (To disadvantaged residents)	NA

Development of an environmental justice program would require effort on the City's part to engage the community and establish the type of collaborative environment that can accomplish proper environmental justice. It may be necessary to employ an Environmental Justice Coordinator to ensure proper devotion of time, resources and expertise to this initiative. Such a position would cost about $75,000 with benefits.

Keys to Equity

Environmental burdens often affect low income residents who are unable to move away. These burdens often lead to negative health effects. These health effects result in hospital bills and medical expenses which put a financial burden on the residents. The City must work to eliminate these environmental burdens so all residents can lead healthy lives with equal opportunities.

Timeline for Implementation
- 1 to 3 years:
  - The City will create and implement a program for environmental justice.

Greenhouse Gas Impact

This recommendation is intended to reduce environmental burdens in our communities. The greenhouse gas impact will be minimal.

Photo from CityBeat

TRANSPORTATION

Diverse and affordable ways of getting from point A to B

Everyone relies on transportation—be that the stride of our own two feet, our own vehicle, a bike, a bus, a streetcar, or the pick-up and delivery of goods and services. Transportation is a key component of our everyday lives. It gets us to where we need to be, and what we need to us.

Transportation networks exist to provide social and economic connections through mobility and access. They contribute to the environmental, social and economic vitality of the communities they serve. The Transportation Task Team of the 2018 Green Cincinnati Plan—comprised of government, corporate, academic, non-profit, faith, community organizations and leaders—understands that the provisions of a transportation network are not absent of footprint or improvement. The advantages of increased

mobility and access should be weighed against the environmental, social and economic costs. As a team, we believe that sustainability, resiliency and equity must be considered in all areas of transportation planning and implementation.

The Transportation Task Team has discussed the success and accomplishments since the 2013 Green Cincinnati Plan, such as the launch of Red Bike and the Cincinnati Bell Connector. We identified significant stakeholders and partners in our regional transportation network and current issues and areas in need of improvement. We developed a set of recommendations, including increased fuel efficiency for the City's fleet, use of alternative fuels and energy, as well as increased funding, support and interconnectivity among mass transit, bicycling and pedestrian infrastructure.

We're establishing measurable goals for evaluating and tracking progress throughout the next five years. All the while, considering who benefits, who doesn't, who bares the impact, cost and/or burden. Equitable access to transportation is integral to the success of true connectivity.

This discussion and deliberation among City and community leaders, though occasionally divisive and still in need of more diverse representation, will continue to move the needle in our transportation planning and incubate ideas and actionable efforts. Together we will accomplish more and better progress.

Elese Daniels
Red Bike
Transportation Team member

Goals

1) DECREASE THE CONSUMPTION OF FOSSIL FUELS, INCLUDING GAS, DIESEL, AND NATURAL GAS BY 20%.

Draft 2018 Green Cincinnati Plan
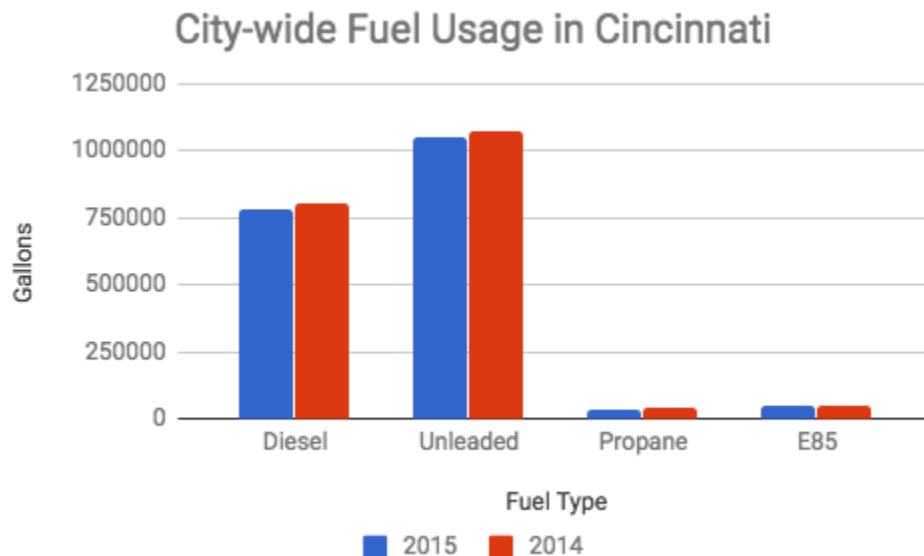
Year	Diesel (g)	Unleaded (g)	Propane (g)	E85 (g)
2015	782,667,000	1,052,598,000	37,916,000	47,371,000
2014	801,465,000	1,069,579,000	44,817,000	47,434,000

City-wide fuel usage is determined by wholesale fuel sales from regional distributors. Citation: City of Cincinnati Office of Environment and Sustainability, 2017.

2) INCREASE THE PASSENGER MILES TRAVELLED VIA PUBLIC TRANSIT BY 5%.

Passenger Miles Traveled via Public Transit in Cincinnati
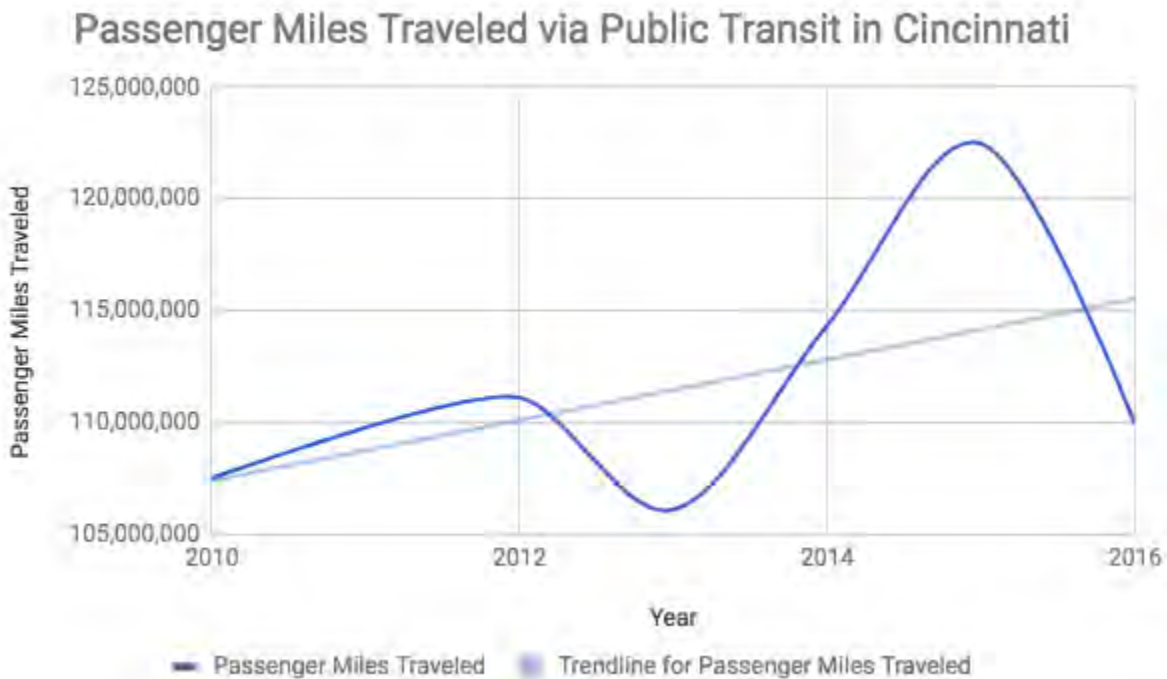
Year	Passenger Miles Traveled via Public Transit (GU)	Passenger Boardings	Total Ridership, Bus-Rail (National Ridership Map)	% Public Transit Commute (National Ridership Map)
2016	109,918,000			
2015	122,459,000	15,582,624 (Metro)	20,684,537 20,138,628 (Bus) 72,306 (Rail)	2.102%
2014	114,328,948		21,118,000 20,595,093 (Bus) 63,631 (Rail)	2.093%
2013	106,086,636		21,265,000 20,764,897 (Bus) 50,779 (Rail)	2.125%

2012	111.094,000		21,687,000 21,203,690 (Bus) 30,558 (Rail)	2.253%
2011			23,040,000	2.446%
2010	107,495,000		22,954,000	2.54%
2009			27,304,000	
2008			30,259,000	
2007			30,228,000	
2006			29,538,992	

Passenger miles travelled is the distance travelled by passengers on public transit. For these data, SORTA and TANK represent the bulk of miles measured. Transit authorities make these estimates based off ridership, pass use, survey, etc. Citation: Green Umbrella, 2017.

3) DOUBLE LANE MILES OF BIKE INFRASTRUCTURE.

Miles of Bike Facilities in the Greater Cincinnati Area in 2017

Miles of Bike Trail in the Greater Cincinnati Area (2017)			
Type of Trail	City of Cincinnati	County (includes City)	Greater Region

Total	77.3	151.9	405
Multi-Use Trails	26	100	-
Protected Bike Lanes	2.27	3.9	-
Standard Bike Lanes	20.5	35.8	-
Sharrows	5.5	12.2	-

Multi-use trails are used by cyclists, pedestrians, and other recreational users allowed on the trail. Standard bike lanes are painted onto the outer edge of roadways, and protected bike lanes use planters, curbs, parked cars, or other barriers to separate the bike lane from the roadway. Sharrows are shared lane markings on roadways; the marking is placed in the travel lane where people should preferably cycle. Tri-State Trails tracks and maps the number of miles of trail every year. Citation: Tri-State Trails, 2017.

Recommendations

Many of the recommendations of this plan are inter-related, and have multiple benefits. For additional recommendations related to Transportation, please see:

- *Built Environment #2: Encourage population density and transit-oriented development in appropriate locations through zoning and incentives.*
- *Built Environment #5: Incorporate complete street principles in all new roadway and rehabilitation projects.*

1. Prepare for the adoption of autonomous vehicles, starting with a pilot project.

What is it and why is it important to Cincinnati?

Cincinnati will help convene a team of key stakeholders to implement an autonomous vehicle (AV) pilot project in Cincinnati.

The technology for autonomous vehicles has been rapidly improving and is quickly becoming viable, especially in cities. Autonomous cars are proving themselves safer than human drivers and the technology is gaining social acceptance. A survey from Pittsburgh where autonomous vehicles have been in road tests for more than a year found that the public feels safer interacting with autonomous vehicles than with human-operated vehicles. It will take time for consumers and lawmakers to fully embrace autonomous vehicles, but eventually their safety and efficiency will win out. For cities, autonomous cars offer a reliable transportation option and allow urban spaces currently committed to parking, to be freed up for other uses.

The City of Cincinnati can make itself attractive for autonomous car pilot programs by creating legislation that encourages autonomous vehicles in the City. Many of the first autonomous car programs will come in the form of ride-sharing programs, simply without the driver. Implementing a successful car-sharing program is another way to present the City as an attractive market for autonomous vehicles. For some communities, autonomous shuttle buses have been the first test of public AVs. A UC circulator,

Fountain Square to U Square bus, or crosstown circulator from the Museum Center to the Casino might be a good AV pilot project.

The shift to autonomous vehicles will likely have many environmental benefits. Autonomous cars reduce the carbon footprint of the transportation sector, reduce the need for parking spaces, and make travel safer for residents by removing the human driver.[142] However, there are many unanswered questions about their impact on society and the economy. AVs will likely replace and, in some cases, eliminate jobs in certain sectors, and Cincinnati will need to prepare for this shift. The City will work with local transportation groups to educate residents about the benefits and drawbacks of autonomous vehicles and their safety, and prepare for their potential social impacts.

Examples in Cincinnati and Peer Cities

- Cincinnati, OH
    - CVG Airport is exploring a driverless shuttle program.
        - https://www.cincinnati.com/story/money/2017/12/20/driverless-shuttles-horizon-cvg-university-cincinnati-shuttles-could-available-tprogram-could-implem/962322001/
- Pittsburgh, PA
    - Pittsburgh formed collaboration with Uber to pilot AV technology
        - http://www.govtech.com/fs/5-Reasons-Pittsburgh-is-Still-Tops-in-Autonomous-Vehicles.html

Who could help with implementation?
- Venture Smarter
- Department of Transportation and Engineering

Who is the target audience?
- Cincinnati residents

What is the City of Cincinnati's role in implementation?

The City of Cincinnati will convene a team of stakeholders to create an autonomous vehicle pilot program.

Is it feasible?
- Feasibility: Medium
    - AV technology continues to improve making them closer and closer to being implemented on a wide-scale. This creates an opportunity to get in early and help AVs come to Cincinnati.

How much will it cost?

Cost	Benefit	Cost-Benefit Ratio
Minimal/None (To City of Cincinnati)	TBD (To City of Cincinnati and partners)	NA

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[142] (Bike PGH, 2017)

Development of an autonomous vehicle pilot program can rely on lessons from numerous models in America and around the world. Once a team of key stakeholders is established they may begin development of strategic planning and risk management. There are many companies looking for suitable environments to test their equipment and the City may lean on this market of prospective developers to cover most of the capital intensive technological aspects of this recommendation.

Keys to Equity
- Autonomous shuttle busses must be free or affordably priced so everyone can use them.
- Autonomous car share services should eliminate barriers such as credit card requirements or expensive memberships.
- Consideration should be given to the economic shifts associated with less need for automobile-related jobs (drivers, mechanics, etc.) Plan for workforce development training to help workers transition.

Timeline for Implementation
- 1-2 years
  - An autonomous shuttle bus pilot project will be approved in 1 year, and operational in 2 years.
  - A driverless car share service will be operational in Cincinnati in 3-5 years.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
0 mtCO$_2$e	72,135 mtCO$_2$e	1,351,763 mtCO$_2$e

Adoption of autonomous vehicles has potential to significantly reduce our region's GHG emissions. The potential reductions are driven by the efficiency of AVs, the ability for AVs to reduce on road congestion, and the impact of AVs on total vehicle miles travelled. A study by Intelligent Transportation Society of America estimates that the gradual introduction of AVs will help reduce vehicular emissions by 2-4% per year moving forward. In 2015, Cincinnati reported community-wide transportation emissions of 2,404,500 mtCO$_2$e. We assume 3% reductions by 2023, followed by an annual reduction of 2% as AV utilization increases.[143,144]

2. Encourage the use of electric vehicles through City programs that incentivize EV ownership and infrastructure.

What is it and why is it important to Cincinnati?

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[143] (Pyper, 2014)
[144] (Information Technology Intelligence Council, 2017)

Draft 2018 Green Cincinnati Plan

Electric vehicles (EVs) are a rapidly growing market-share in the United States and are seen as the future of the automobile industry. EVs are more reliable and lower maintenance than the traditional car because electric motors have fewer moving parts and need no oil changes or tune-ups. The cost of charging an electric car at home is much cheaper than buying gas, which can fluctuate drastically, making electric cars cheaper to own and operate than traditional vehicles. The biggest hurdle this technology still faces is the range and charge time of electric cars which can be an issue on long trips, but new innovations are solving this problem. As the world moves toward electric cars, adoption will happen faster in Cincinnati if the City creates incentives and implements electric car infrastructure.

The City already incentivizes electric cars by providing free parking at any City-owned parking meter and one garage. To further encourage electric cars in Cincinnati, the City will encourage electric car infrastructure in and around the City. That way it is easy for electric car users to find a charging station wherever they are. One way the City can achieve this is by changing the City's Code to require any new parking garage or parking lot to be built with a minimum number of charging stations. This would allow the City to create the infrastructure without having to carry the entire burden of the cost. All new or rehabbed City parking facilities will include a minimum number of charging stations.

The City should invest in electric vehicles for the City fleet. As old vehicles are retired from the fleet, they should be replaced with electric vehicles if a suitable electric vehicle exists, and the cost premium will be recouped during the life of the vehicle through fuel and maintenance savings.

Examples in Cincinnati and Peer Cities
- Columbus, OH
    - Columbus is launching an incentive program for electric vehicle charging infrastructure.
        - http://www.govtech.com/fs/Columbus-Ohio-to-Launch-Incentive-Program-for-EV-Charging-Port-Installation.html

Who could help with implementation?
- Office of Environment and Sustainability
- Duke Energy
- Clean Fuels Ohio

Who is the target audience?
- Cincinnati residents

What is the City of Cincinnati's role in implementation?

The City of Cincinnati will encourage the strategic implementation of EV infrastructure.

Is it feasible?
- Feasibility: Medium
    - Cincinnati has an active EV community, and many peer cities are deploying EV infrastructure.
- Obstacles:
    - Builders of new parking infrastructure may be reluctant to invest up front in electric vehicle charging stations as an additional cost of their project.

How much will it cost?

Cost (for 100 L2 Chargers)	Benefit	Cost-Benefit Ratio (5 years)
$200,000 (To City of Cincinnati)	$60,000/yr. (To City of Cincinnati)	1.5:1

A basic Level 2 charger costs about $2000 installed, and can be rented to an EV owner for about $2/day or $50/month, plus the cost of electricity. To install 100 chargers in the first year would cost $200,000, and would pay back $60,000 per year.

There are currently 84 public charging stations within 20 miles of Downtown Cincinnati[145]. The cost of a single port EVSE unit ranges from $300-$1,500 for Level 1, $400-$6,500 for Level 2, and $10,000-$40,000 for DC fast charging. Installation costs vary greatly from site to site with a ballpark cost range of $0-$3,000 for Level 1, $600- $12,700 for Level 2, and $4,000-$51,000 for DC fast charging[146]. It is worth noting that the level three charger is not compatible with all EVs, the market may or may not standardize this equipment. The State of Ohio offers financial assistance in the form of a loan to cover ¾ of project costs (up to $750,000.00) which can help to cushion the upfront costs of this undertaking. The rate charged to customers can also help mitigate both upfront costs and operating costs down the road.

Keys to Equity

The spread of electric vehicles must be accompanied by improvements to transit and other mobility solutions. While EVs improve vehicle affordability, private cars will likely remain beyond the reach of many residents.

Timeline for Implementation
- An initial deployment of chargers can happen within 1 year. Additional chargers should be installed annually for the foreseeable future.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
3,300 mtCO$_2$e	17,768 mtCO$_2$e	1,202,500 mtCO$_2$e

While electric vehicles have zero tailpipe emissions, they have CO_2 emissions associated with electricity generation. The CO_2 savings of electric vehicles depends on the electricity source used to charge the battery. Based on the average CO_2 emissions from electricity generation in Ohio in 2017, an all-electric vehicle has "well-to-wheel" CO_2 emissions about 40% lower than a conventional gasoline vehicle[147]. Homeowners who charge their vehicles at homes powered by the City's 100% green energy aggregation program or with solar installations will have greater CO_2 savings. As Cincinnati moves

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[145] According to the map generated on solvingev.com. Accessed December 2017.
[146] (UD Department of Energy Vehicle Technologies, 2015)
[147] (U.S. Department of Energy, 2017)

toward a greater mix of renewable sources, the CO_2 savings of electric vehicles will also grow. Ohio has a larger proportion of coal-fired power plants than the national average, which means that electric vehicles charged in Ohio have a higher CO_2 footprint than the national average.

Electric vehicles in Ohio are estimated to produce 6,911 pounds (3.14 mt) CO_2 per year, compared to 11,435 pounds (5.18 mt) CO_2 per year for gasoline powered vehicles. Approximately 60% of Cincinnati homes are powered by renewable energy through the Energy Aggregation Program, eliminating the CO_2 emissions of the vehicle. We estimate 840 EVs are operating in Cincinnati in 2018. Electric vehicle sales are expected to experience 40% annual growth over the next 5 years. Projecting EV adoption trends beyond 2023 is very difficult, as EV technology is intertwined with autonomous vehicle adoption. For purposes of estimation, we project the pace of sales to slow, but for electrification to eliminate 50% of current transportation emissions footprint.[148,149]

3. Pursue car sharing service in Cincinnati as an equitable mobility solution.

What is it and why is it important to Cincinnati?

The City of Cincinnati's car-share program will be a partnership between the City and a car-share service provider. Car sharing is a service that provides members with access to an automobile for short-term use, usually on an hourly basis. The shared cars are distributed across a network of locations within a metropolitan area. Members can access the vehicles at any time with a reservation and are charged by time, by mile, or a combination of both. Car sharing provides some of the benefits of a personal automobile without the costs of owning a private vehicle.

The City wants a service that complements the existing transportation network. One of the biggest obstacles to public transit is that it operates on a fixed route which limits where riders can go. Car-sharing allows users the opportunity to go wherever they need to go, whenever they need to be there. This dynamic form of transportation provides full mobility to residents who are unable to afford their own car or who have chosen not to own a car.

For every shared vehicle, at least 10 privately owned cars are taken off the road as residents rely on car-share instead of car ownership. This reduces carbon emission by reducing the number of cars on the road. This also reduces traffic congestion within the city which reduces emissions by reducing the time cars are stuck idling on the roads. Perhaps the biggest environmental impact of car-sharing is the behaviors it encourages. Car-sharing encourages users to rely on different forms of transportation to reach their destination. A user may take a red bike or bus to work, but take a car share to go grocery shopping. Relying on different forms of transportation reduce the carbon footprint of each user and gets them thinking about the sustainable behaviors they adopt.[150]

Examples in Cincinnati and Peer Cities
- Indianapolis, IN

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[148] (U.S. Department of Energy, 2017)
[149] (International Energy Agency, 2017)

[150] (Shared-Use Mobility Center, 2017)

- BlueIndy in Indianapolis is the first electric car-sharing service in North America. Once a car is taken out, it can be returned to any of the BlueIndy stations around the city.
- Columbus, OH
  - Car2Go is a versatile car-sharing program that allows you to take a car and return it to any public parking spot within particular regions of the city.
- Los Angeles, NV
  - Blue LA is the first car-share to ever specifically target low-income communities in hopes of creating new opportunities for LA's low-income communities.

Who could help with implementation?
- Third party car sharing provider
- Office of Environment and Sustainability
- Cincinnati Chamber of Commerce - Leadership Cincinnati
- Department of Transportation and Engineering

Who is the target audience?
- High density areas of Cincinnati
- Low income residents

What is the City of Cincinnati's role in implementation?

The City of Cincinnati will be responsible for selecting a provider to implement a new car-share service for the City. The City will oversee the implementation of the program and ensure that it addresses equity. The City will also work with the provider to ensure that the provided service compliments the City's parking infrastructure.

Is it feasible?
- Feasibility: Hard
  - The City of Cincinnati is currently working with Leadership Cincinnati to identify a qualified car share provider.
- Obstacles:
  - Implementing an equitable car-share can be difficult because most models require areas of high density to be successful which do not always include the areas that would benefit most from a car-share service.

How much will it cost?

Cost	Benefit	Cost Benefit Ratio
$0.00 (To City of Cincinnati)	$ 2,228,500/year (To City of Cincinnati)	NA

Actual costs won't be known until a vendor is identified and a contract is signed. Under the City's current car-share contract with ZipCar, the City pays nothing and receives $200/month for use of 6 parking spaces. It is likely that a new contract will have no cost to the City.

If the car share provider places 50 cars in Cincinnati, this will enable 500 people to give up their car. The average person saves $4,457/year if they don't own a car. The net avoided cost of car ownership would be $2,228,500/year.

Keys to Equity

Car-sharing offers another form of reliable transportation that can be used to go anywhere around the City. When an affordable model is created, this provides increased mobility for low income residents and opens them to new opportunities, such as access to better jobs with a shorter transit time.

Timeline for Implementation
- Expected: 1 - 2 years
  - Leadership Cincinnati has adopted this project for the year ahead ensuring that progress will continue to be made with a strong system of support behind it.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
370 mtCO$_2$e	1,850 mtCO$_2$e	18,500 mtCO$_2$e

Cars emit 3.7 mtCO$_2$e per 10,000 miles traveled. We assume 100 people utilize car share to replace their car in year one, 500 people by 2023, and 5,000 by 2050.

4. Green the Fleet: Improve the fuel efficiency of the City's Fleet.

What is it and why is it important to Cincinnati?

The City of Cincinnati fleet includes almost 2,500 pieces of equipment. Many operate on a 24/7 schedule to maintain critical services to the residents of Cincinnati. The Cincinnati fleet is currently undergoing significant upgrades through the Capital Acceleration Plan (CAP) which will purchase $40 million worth of vehicles over the next 12 years. This investment is critical as before the CAP, the City's fleet was out-of-life cycle causing significant costs in maintenance and downtime.

With the transportation sector being the single largest contributor of greenhouse gases in our region, the City has a responsibility to do its part by reducing the emissions from its own fleet. Upgrading Cincinnati's fleet to a more reliable and more efficient fleet is the first priority. This investment in vehicle replacement will reduce maintenance costs, provide fuels savings, reduce emissions and reduce vehicle downtime. However, to go further the City will require additional investment. Electric vehicles, idle reduction technologies, alternative fuels and supporting infrastructure require additional capital.   The VW Emissions Settlement has made available significant funding to the replacement of pre-2010 class 4-8 diesel vehicles. The City will work with partners to apply for grant funds to replace out-of-lifecycle diesel vehicles. Additional funding opportunities exist through the Diesel Emissions Reduction Grant (DERG). Both programs are administered by the OEPA.

If funds are awarded they will be used to offset already allocated expenses through the CAP fund. The offset CAP funding will be placed in a "Green Fleet Fund" and be used to pilot fuel saving and emission

reducing technologies such as battery backed idle reduction, electric vehicles, route optimization, compressed natural gas and alternative fuel infrastructure to support vehicles. Additional fuel savings through the implementation of new technologies could be placed in the "Green Fleet Fund" as well further enhancing the Cities ability to transition to newer, lower emitting technologies. The continued vehicle replacement through the CAP Program and the additional emissions reductions/fuel savings through technologies implemented through the "Green Fleet Fund" will allow the City to reduce overall fuel consumption by 15% by 2023 and 50% by 2028.

Examples in Cincinnati and Peer Cities
- Columbus, OH
    - The City of Columbus has been working since 2009 to make all City owned vehicles more efficient, reducing their impact on the environment.
    - https://www.columbus.gov/uploadedfiles/Finance_and_Management/Asset_Management_Division/Fleet_Management/GreenFleetUpdate-mid09%5b1%5d.pdf

Who will be taking the leading roles on this project?
- Public Services

Who is the target audience?
- City of Cincinnati fleet

What is the City of Cincinnati's role in implementation?

The City of Cincinnati will continue to improve the City's fleet through the CAP program. It will be responsible for identifying and acquiring grants and outside funding that will allow the City to pilot alternative fuels and technologies to reduce fuel consumption.

Is it feasible?
- Feasibility: Medium
    - The City of Cincinnati has already begun reducing its fleet emissions and fuel consumption through the CAP program.   To implement the "Green Fleet Fund" will require the City being awarded funding through the OEPA or other sources and approval by City Council to appropriate offset CAP funds to the "Green Fleet Fund".

How much will it cost?

Cost (Idle Reduction)	Benefit	Cost-Benefit Ratio (3 years)
$175,000 (To City of Cincinnati)	$75,000 (To City of Cincinnati)	1:1.29 (2.3-year payback)

Cost of this program will be highly dependent on the technologies selected. Idle management technologies in police cruisers costs approximately $3,500 per car. Installing this technology as new vehicles are placed on line, approximately 50 per year, will result in an overall cost of $175,000 per year with an expected return of $75,000 in fuel savings. Electric vehicles have an incremental cost of approximately $10,000 when compared to traditional gas cars. Expected return on fuel savings is $800-12,000 per year.

One long term method to reduce fuel consumption is to purchase vehicles with enhanced, market leading fuel economy. The Department of Transportation estimated in 2015 the average fuel economy of US light duty vehicles was 22 mpg. To achieve 15% improved fuel economy from this baseline the City could acquire vehicles with an average 25.3 mpg. At $2.75 for a gallon of gas for a fleet that travels 500,000 miles per year a fleet with an average 22 mpg would spend $62,500 on fuel. The same fleet VMT averaging 25.3 mpg would spend $54,374 on fuel, saving $8,135 or 13%[151].

Keys to Equity
- Reducing overall emissions and increasing lifespan, decreasing asthma.

Timeline for Implementation
- 1 - 2 years
    - Volkswagen settlement money may be used to help green the fleet.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2028	2035
537 mtCO$_2$e	2,686 mtCO$_2$e	8,954 mtCO$_2$e	17,908 mtCO$_2$e

In 2015, City of Cincinnati's fleet emitted 17,908 mtCO$_2$e. This recommendation calls for a 15% improvement in fuel efficiency by 2023, and a 50% improvement by 2028. By 2035, fleet operations are expected to be carbon neutral.[152]

5. Encourage corporate sponsorship of transit passes and infrastructure to encourage employee bus and bikeshare ridership.

What is it and why is it important to Cincinnati?

The Cincinnati region is home to more fortune 500 companies per capita than New York or Chicago. With such a large corporate presence, it is important for these corporations to do their part in reducing their greenhouse gas footprint. Corporations can do that by encouraging employees to commute via bus and bike, and by reducing the size and improving the efficiency of their vehicles fleets. Providing corporate sponsorship of passes is one way to encourage public transit and bike use.

Corporate sponsorship of transit and bike share passes can help companies reduce the size of their fleet and reduce the costs of owning, maintaining, and parking the vehicles. Employees benefit from reduced fuel and parking cost. Use of transit for commuting reduces traffic congestion and carbon emissions as people share a bus ride rather than driving their own car. This also encourages employees to think about how they are getting to and from work, promoting the use of mixed modal transportation in the City. Metro's guaranteed ride home program provides bus users with a safety net in the case of an

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[151] (U.S. Department of Transportation, 2018)
[152] (U.S. EPA, 2017)

emergency, making the bus system more viable as an alternative to driving. Corporations will be encouraged to invest in transit and bike share passes for their employees to reduce their own costs and encourage sustainable behaviors among employees.

Examples in Cincinnati and Peer Cities
- Cleveland, OH
  - Green Employee Commuting
    - http://www.city.cleveland.oh.us/sites/default/files/forms_publications/SC-MAP_Final_10.1.13.pdf
- Columbus, OH
  - Challenges businesses to offer incentives for their employees to use alternate modes of transportation.
    - https://www.theguardian.com/cities/2017/oct/03/free-public-transport-downtown-workers-columbus-car

Who could help with implementation?
- METRO
- Better Bus Coalition
- Ohio-Kentucky-Indiana Regional Council of Governments
- Red Bike

Who is the target audience?
- Cincinnati businesses and corporations

What is the City of Cincinnati's role in implementation?

The City will partner with a group of transportation leaders that can work with Cincinnati businesses to incentivize the use of alternate modes of transportation.

Is it feasible?
- Feasibility: Medium
  - Peer cities work with local businesses to increase employee transit use. Levels of success vary from city to city.
- Obstacles:
  - Most Cincinnati residents rely on their personal car to get to and from work. Even with an incentive program, it will be difficult to get residents to change their daily habits, especially for those who do not have a transit connection near them.

How much will it cost?

Cost (for a 6,000-employee company)	Benefit	Cost-Benefit Ratio
$15,000 (To employer)	$60,000 (To employer)	1:4

UC has an arrangement with Metro that enables all 60,000 UC faculty, employees and students to ride Metro for $1 per ride. UC pays Metro $150,000/year for this arrangement. An employer the size of City Government (6,000 employees) could offer employees $1 fares at an annual cost of about $15,000. According to the American Public Transit Association, a 10% change in bus fares results in a 4% change

in ridership. Therefore, this fare reduction of about 40% will yield a 16% ridership increase. This would boost the bus mode share in Cincinnati from 3% to 3.5%, or 30 additional transit riders in a 6,000-employee company. The cost to provide a parking space in an urban surface lot is about $2,000 per year, so if this employer provides employee parking, they can save $60,000/year just by eliminating 30 parking spaces.[153]

Keys to Equity

Car ownership is one of the largest expenses for the average American. Creating a reliable and affordable public transit system for employees would allow some families to reduce their reliance on a personal car, creating a chance to reduce their monthly bills.

Timeline for Implementation
- 1 - 2 years
  - The City will organize corporate partners and transit leaders to offer transit opportunities to corporate employees.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
470 mtCO$_2$e	2,350 mtCO$_2$e	15,040 mtCO$_2$e

A typical passenger vehicle emits 4.7 mtCO$_2$e per year. We assume a corporate sponsorship program could help 100 employees a year opt to use bike or bus for daily commuting in year one. We assume this number will increase by 100 employees per year.[154]

6. Improve neighborhood walkability, by improving sidewalk connectivity and pedestrian safety, especially in low-income neighborhoods.

What is it and why is it important to Cincinnati?

Walkability is important for maintaining a healthy and stable community. Walking is a healthy, affordable and environmentally friendly way to get around the neighborhood. The City will work to improve sidewalks and other pedestrian infrastructure in need of repairs and build new sidewalks, especially in low income neighborhoods. Sidewalks are important to every member of the community as they connect residents with local stores, access to transportation (bus stops especially), jobs, schools, parks, etc.

The City will seek a new way to fund and build adequate sidewalk infrastructure. Currently, property owners are expected to bear the costs of sidewalks, whether or not they are willing and able to. The City

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[153] (Victoria Transport Policy Institute, 2017)
[154] (U.S. EPA, 2017)

should fund repairs and new sidewalks because the sidewalk is public infrastructure, just like the road. The cost of sidewalks should come from a new revenue sources specifically earmarked for sidewalks. Like roads, street trees, water pipes, sewers, and streetlights, public infrastructure should not be the responsibility of private land owners.

Intersections, including traffic signal settings, curb cuts, and crosswalks, are important elements of a neighborhood's walkability. Efforts to improve walkability will focus on intersections in addition to sidewalks.

For low income residents, sidewalks and walkable intersections are important because many do not own cars and rely on the public transit system. Sidewalks not only provide residents with safe paths throughout their own neighborhoods, but also improves access to different modes of transportation. Access to transportation opens the door for new job opportunities for disenfranchised residents. Neighborhood walkability creates opportunities and strengthens the sense of community for Cincinnati residents. The City will improve and expand its sidewalk network and walkable intersections.

Examples in Cincinnati and Peer Cities
- Madison, WI
  - The City of Madison is working to identify the current conditions of neighborhoods around the City, including neighborhood walkability, to better plan for future development.
- Columbus, OH
  - The City of Columbus is working to increase the rate of sidewalk installations around the City.

Who could help implement this project?
- Department of Transportation and Engineering
- Tristate Trails

Who is the target audience?
- Low income communities
- Areas near bus stops
- Cincinnati neighborhoods without adequate sidewalks

What is the City of Cincinnati's role in implementation?

The City of Cincinnati will be responsible for continuing to identify sources of funding so new trails and sidewalks can be put in throughout Cincinnati neighborhoods.

Is it feasible?
- Feasibility: Hard – Financing for sidewalks and trails can be hard to find. A new fee would require a public vote. In exchange for that fee, land owners will no longer be financially liable for the cost of sidewalks.

How much would it cost?

Cost per mile	Benefit per mile	Cost-Benefit Ratio

$160,512 (To DOTE)	$126,000 (To DOTE)	1.27:1

Cincinnati currently has 1700 miles of improved sidewalk valued at over $215 million [1][155]. This boils down to $126,000 in value attributed to each mile. Cincinnati Sidewalk Safety reports that the average cost to produce a mile of sidewalk runs around ±$130,000; it is important to bear in mind also that $1 in preventive maintenance can save $6-$10 down the road[156].

Sidewalks enhance the resale value of property, sometimes adding as much as 15x their cost to the property's sale price. According to AARP, retail property with a WalkScore rating of 80-100 were 54% more valuable than retail property with a walk score <20[3][157]. Increases in desirability, reduction in crime and improvements in community health can all be tied to greater sidewalk infrastructure. Individuals living in low-income and racial/ethnic minority communities experience disproportionate access to environmental features that support physical activity[158].

Pedestrian Safety is a major component of walkability. Between fiscal year 2016-2017 there was an 11% spike in pedestrian fatalities[159]. More specific data can inform us that the pedestrian crash risk for crossing the arterial without a median was 6.48 times higher than for crossing the arterial with a median. Pedestrian crashes account for 12% of traffic fatalities annually-75% of these are not at intersections. Providing raised medians or pedestrian refuge areas at pedestrian crossings at marked crosswalks has demonstrated a 46 % reduction in pedestrian crashes. At unmarked crosswalk locations, pedestrian crashes have been reduced by 39% with the same development [6][160]. The average cost of a pedestrian fatality in a motor vehicle incident is just under $5 million (adjusted to present value) [7][161]. Raised medians alone have been found to reduce motor vehicle crashes by 15 percent, improve travel time reliability, provide space for landscaping within the right-of-way (which can be utilized to reduce urban heat island effects), and can be less expensive to build and maintain than paved medians.

Keys to Equity

Walkable neighborhoods allow residents to get out and walk from one place to another rather than always having to rely on a personal car or public transit system. Walking is the cheapest transportation option. Walking is also healthier and helps residents get out and enjoy the fresh air, promoting a happier lifestyle.

Timeline for implementation
- 3 - 4 years
  - The City will identify areas that need sidewalks and work with partners to improve the walkability and safety for pedestrians of Cincinnati neighborhoods.

Greenhouse Gas Impact

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[155] (City of Cincinnati, 2017)
[156] (Carrillo, 2012)
[157] (AARP, 2014)
[158] (Kelly, 2007)
[159] (Retting & Schwartz, 2016)
[160] (U.S. Department of Transportation, 2013)
[161] (National Safety Council, 2017)

Annual Carbon Reduction Potential

2018	2023	2050
0 mtCO$_2$e	7,050 mtCO$_2$e	14,100 mtCO$_2$e

A typical passenger vehicle emits 4.7 mtCO$_2$e per year. We assume improved connectivity of sidewalks helps 30,000 residents take 5% of their local travel by foot or by bike after 5 years. We assume that increases to 10% of travel by 2050.[162]

7. Police enforcement & legislative support for bike & pedestrian safety.

What is it and why is it important to Cincinnati?

According to the Census Bureau, 0.9% of Cincinnati commuters travel by bicycle. Some Cincinnatians say that Cincinnati is too hilly for bicycles, or that the weather is not suitable, but San Francisco is hillier and more than 4% of San Francisco commuters travel by bike, and Minneapolis is much colder and more than 4% of commuters in Minneapolis bicycle. Cincinnatians could bicycle far more than they do.

One thing that holds Cincinnatians back from biking is the perception that it is unsafe. To significantly improve safety, and the perception of safety, for bicycles and pedestrians in Cincinnati, it is necessary to improve bicycle infrastructure, to create laws that mandate safe conduct by cyclists and drivers of motor vehicles, and to enforce those laws. Creating an interconnected pathway system will allow bikers and pedestrians to move around the City safely. It is important to have proper signage and street markings so cars can safely travel with bikers and pedestrians. Giving bikes and pedestrians the right of way and working to create bike lanes and sharrows will go a long way in improving safety. Local law enforcement must enforce laws that ensure the safety of bikers and pedestrians in Cincinnati.

It is important to educate both bikers and pedestrians in addition to drivers of the rules and regulations around walking and biking. This ensures that vehicles and bikes respect one another on the road and are aware of the proper road etiquette. Biking and pedestrian safety is important because the City wants to encourage people to use these economical and environmentally friendly modes of transportation to get around Cincinnati.[163]

Examples in Cincinnati and Peer Cities
- Madison, WI

Who could help implement this project?
- Community Councils
- Department of Transportation and Engineering
- All local Police Departments and agencies

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[162] (U.S. EPA, 2017)
[163] (The League of American Bicyclists, 2015)

Who is the target audience?
- Cincinnati cyclists
- Pedestrians
- All Cincinnati residents

What is the City of Cincinnati's role in implementation?

The City of Cincinnati will be responsible for the education and enforcement of laws surrounding safety for bikers and walkers.

Is it feasible?
- Feasibility: Medium

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio
$15,000 (To combined Police Departments)	$5.3 million saved (To general public)	1:353

The cost of enforcement of cycling laws is small when we consider the danger of not enforcing. The economic cost of the average cycling fatality to the community in 2012 was $4,538,000. The average cost of injury was $58,700, and if the injury was incapacitating, $230,000[164]. The best way to offset this is with both passive and active enforcement of laws to ensure cyclist safety.

Keys to Equity

Walking and biking are cost effective ways to get around from place to place. Making it safe and easy to get around the City by walking and biking will provide low-income residents with a means to get around for a low cost. It also gets people active and exercising at the same time.

Timeline for Implementation
- Expected: 1 - 2 years
  - The City will be able to take a few quick steps to better enforce pedestrian and biking safety.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
0 mtCO$_2$e	7,050 mtCO$_2$e	14,100 mtCO$_2$e

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[164] (Pedestrian and Bicycle Information Center, 2012)

A typical passenger vehicle emits 4.7 mtCO$_2$e per year. We assume improved connectivity of sidewalks helps 30,000 residents take 5% of their local travel by foot or by bike after 5 years. We assume that increases to 10% of travel by 2050.[165]

8. Enhance public transit.

What is it and why is it important to Cincinnati?

Transportation is essential to life in Cincinnati, providing residents access to employment, food, and healthcare. Transportation currently accounts for approximately a third of our City's greenhouse gas emissions. Enhanced public transit may include multiple strategies:

- Alignment of public transit routes and schedules with employment, health care, and educational opportunities
- Implementation of electric buses
- Implementation of Bus Rapid Transit (BRT) along major transportation corridors
- Partnering with alternative transportation services, like car share, rideshare, and bikeshare
- Development of a tap card system to pay fares on multiple platforms
- Explore the use of dedicated bus lanes

The Southwest Ohio Regional Transit Authority (Metro/SORTA) is the overseeing body of the Cincinnati public transit system. They are currently facing a significant budget shortfall. Additional funding is needed to maintain the current level of service. Without additional funding SORTA will have to raise bus fares and cut bus routes throughout the City. The Cincinnati region should be working to expand and improve its bus system creating new opportunities for its residents rather than cutting what they have. To achieve a steady and adequate revenue stream, a regional funding mechanism is essential.

One source of funding that has been proposed is a 0.5 to 1.0 percent county sales tax. While not large enough to support an optimal transit system, that would certainly be a step in the right direction. Almost every other major metropolitan area in the country has a regional funding mechanism for transit. Cincinnati is one of very few where the City is footing the bill alone. Another proposal is to form a multi-county, multi-state transportation authority to tackle the region's public transportation needs. There are also federal funding opportunities that could be pursued to help with maintaining the funding for SORTA.

An efficient transportation system provides residents with opportunities, reduces the City's carbon emissions, and makes Cincinnati a more attractive place for prospective residents. The City will continue to work with SORTA, Hamilton County, and other regional partners to identify new streams of funding and enable expanded service.

Examples in Cincinnati and Peer Cities
- Madison, WI
  - Madison implemented a Bus Rapid Transit system based on analysis of needs.

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[165] (U.S. EPA, 2017)

- http://www.madisonareampo.org/BRT.cfm

Who will be taking the leading roles on this project?
- Ohio-Kentucky-Indiana Regional Council of Governments
- Better Bus Coalition

Who is the target audience?
- METRO

What is the City of Cincinnati's role in implementation?

The City of Cincinnati will support SORTA to secure reliable funding for transit.

Is it feasible?
- Feasibility: Hard
  - An increase in the sales tax will be challenging and may require a public vote.

How much will it cost?

	Cost	Benefit	Cost-Benefit Ratio
Electric Bus	$250,000 premium per bus (To METRO/SORTA)	$318,000 savings/bus (To METRO/SORTA)	1:1.3 lifetime
Bus Rapid Transit	$21,500,000/mile (To METRO/SORTA)	TBD (To METRO/SORTA)	NPV 1:0.92

The many factors of this recommendation are discussed below:

Realignment of routes and procedures can be conducted by METRO/SORTA for nominal cost.

Electric Busses carry a purchase cost premium of $200,000-$300,000 compared to an average diesel transit bus [1][166]. The City of Cincinnati has roughly 500 busses, some utilizing diesel and others are hybrid variants. Electric busses offer many advantages. Columbia University analyzed a similar proposal for New York City and calculated the reduced cost of ownership at $17,500 per year. Regenerative braking improves brake life 50%-100% and improves fuel economy up to 50%. Lifetime cost savings for electric are estimated at $168,000 per bus and bus payback was estimated to be 5.71 years, combined with an estimated $150,000 of value related to reduction of respiratory and related diseases[167].

Development of BRT will require dedicated bus lanes, thruways and iconic stations. Cleveland Ohio constructed a total 9.38 miles of BRT thruway (58 stations and 24 vehicles) at a total cost of $200 million[168]. This is roughly $21,500,000 per mile, while variable engineering costs do play a large factor. Upon examination of their BRT program, Madison, Wi estimated a NPV of project benefits to be 92% of

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[166] (Environmental and Energy Study Institute, 2007)
[167] (Aber, 2016)
[168] (National BRT Institute, 2015)

capital costs over a 30-year project lifetime[169]and annual operating costs in Seattle reduced to $2.7 million per mile[170].

Partnering with rideshare services can be done for little to no cost and is greatly enhanced by the AV pilot program (see Transportation #10).

A multi-platform payment system can be accomplished with the mobility app (Transportation #9).

Keys to Equity
- Improve access to transit for low income neighborhoods.
- Keep transit fares low, or have a subsidy for those who need it.

Timeline for Implementation
- 1 - 2 years
    - METRO is facing a budget deficit and will need additional funding soon to maintain its current services.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
0 mtCO$_2$e	2,033 mtCO$_2$e	8,134 mtCO$_2$e

An enhanced transportation system will increase public transit ridership by 5% over 5 years. In 2016, regional public transit authorities reported a total of 109,918,000 passenger miles travelled. A 5% increase would mean an additional 5,495,900 miles travelled via transit rather than personal automobile. Cars emit 3.7 mtCO$_2$e per 10,000 miles traveled. This increase in public transit ridership would yield a GHG reduction of 2,033 mtCO$_2$e. A 20% increase by 2050 would create an additional 21,983,600 public transit passenger miles travelled and would yield a GHG reduction of 8,134 mtCO$_2$e.

9. Increase connectivity and cohesion within multimodal transportation options.

What is it and why is it important to Cincinnati?

Cincinnati has a wide range of transportation options (bus, streetcar, bike share, ridesharing, carpooling, etc.). To provide the most effective transportation network for its residents, the City will increase connectivity between the different modes of transportation. Increasing connectivity allows residents to use a combination of transportation options creating a more reliable and efficient transportation network. Residents could, for example, take the bus from their neighborhood bus stop to the nearest Red Bike location and then bike the final leg of their trip.

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[169] (Bloom, Carlson, Mueller, & Scott, 2006)
[170] (Small Starts Project Development, 2016)

One of the most common complaints Metro receives is the lack of a uniform system of payment for the City's transportation options. The City will work with Metro and other transportation partners in the City to create an app that helps people map out mixed modal routes and pay in a uniform system. Ideally, Cincinnati residents could have a single card that would allow them to pay for the bus, Red Bike, rideshare, carshare, taxi, carpooling, the streetcar, and parking all in one platform. With so many different partners with different systems of payment, a one card system may be challenging, but the goal of moving seamlessly through the City is worth the effort. The City will explore a multi-modal mobility app to plan and pay for trips based on minimizing travel time and cost.

The use of shared modes of transportation reduces carbon emissions, decreases traffic congestion, and frees up parking in the City. Streamlining the process into one platform will make residents more likely to take advantage of the existing transportation network because the process will be easier for residents. The City can also evaluate the existing transportation network to identify ways to improve the efficiency of the network. A successful transportation system connects residents with economic opportunities, especially low-income residents who may have limited access to transportation, and reduces the environmental impact of the City's transportation sector.

Examples in Cincinnati and Peer Cities
- Columbus, OH
    - The City of Columbus is working to better integrate its public transit system and ensure that it is adaptable for future transportation technologies.

Who could help with implementation?
- Department of Community and Economic Development
- Office of Performance and Data Analytics
- METRO

Who is the target audience?
- All Cincinnati residents, especially those who already rely on the public transit system
- All mobility providers

What is the City of Cincinnati's role in implementation?

The City of Cincinnati will partner with stakeholders, including Metro, to improve intermodal connectivity. The City will work with a third party to create a multimodal app that will help improve access and cohesion between the different modes of transportation in the City.

Is it feasible?
- Feasibility: Medium
    - It is challenging to synchronize the functions of multiple, incompatible technology systems. However, each system has a relatively short life expectancy, so at worst, compatibility can be a primary requirement when it comes time for system updates.
- Obstacles:
    - Cincinnati, like most US cities developed throughout the 20th century, are designed around the use of personal cars. Cincinnati will need to continue to change its infrastructure so it is better adapted to serve public transit, shared mobility platforms, and walkers and bikers.

How much will it cost?

Cost	Benefit	Cost-Benefit Ratio
~$1,000,000 (To City of Cincinnati)	TBD (To transit users)	NA

Development of a multimodal transportation app will likely require a two-sided marketplace app platform. It will be important for users to know exactly where the bus is or whether there are bikes available. A two-sided market system would enable this flexibility. App development costs can be highly variable. Given the relative complexity this would require, it is likely it could cost $200,000-$1,500,000.[171] An app that allows pay-by-mobile via a credit card is also likely to streamline the process of multiple fare methods.

Keys to Equity

Owning a car is very expensive. Connecting different modes of transportation improves the entire system and makes it easier for residents to quickly get from one place to another. A better mobility system decreases reliance on owning a car and allows more residents to choose a car-free lifestyle.

Improving the transportation system allows Cincinnatians to get from place to place quicker, reducing the time spent commuting to a job or to the store, putting more time back in their lives. This is crucial for low income residents who may be working long hours or multiple jobs to make ends meet.

Timeline for Implementation
- 1 - 2 years
  - A trip planning app with payment functionality will be in use within 1 year. Getting all mobility providers to accept payment via the app may take 2-5 years.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
0 mtCO$_2$e	2,033 mtCO$_2$e	8,134 mtCO$_2$e

A more accessible multi-modal transportation system will help increase public transit ridership by 5% over 5 years. In 2016, regional public transit authorities reported a total of 109,918,000 passenger miles travelled. A 5% increase would mean an additional 5,495,900 miles travelled via transit rather than personal automobile. Cars emit 3.7 mtCO$_2$e per 10,000 miles traveled. This increase in public transit ridership would yield a GHG reduction of 2,033 mtCO$_2$e. A 20% increase by 2050 would create an additional 21,983,600 public transit passenger miles travelled and would yield a GHG reduction of 8,134 mtCO$_2$e.[172]

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[171] (Yarmosh, 2017)
[172] (U.S. EPA, 2017)

10. Create a transit link between Downtown and Uptown.

What is it and why is it important to Cincinnati?

Downtown and Uptown are Cincinnati's largest centers of employment. Improved transit options to connect the two areas will help connect people to jobs, entertainment, education, and health care. In 2016 the City of Cincinnati completed construction of the Cincinnati Bell Connector, the City's streetcar. The streetcar operates on 3.6-mile fixed loop that connects the riverfront at The Banks with Downtown and Over the Rhine. The streetcar has spurred significant investment in real estate development projects along its route. Connecting the streetcar to Uptown would help create new economic opportunities for the City.

An expanded streetcar is one way to link the current streetcar to Uptown. Other possibilities that merit consideration include underground rail, aerial tram, and bus options. The City will conduct a feasibility study comparing various options for connecting downtown to uptown, and will build a transit connection based on the results of that study.

Examples in Cincinnati and Peer Cities
- Cleveland, OH
    - The City of Cleveland is working to improve transit connections through a variety of methods between their main business centers to reduce the amount of travel residents and employees will need to make between them.
- Portland, OR
    - Portland's Aerial Tram travels 3300 feet at 22 miles per hour and rises 500 feet. The 2 cars hold 79 people each and carry 20,000 passengers per day. Construction cost was $57 million.

Who could help with implementation?
- METRO
- Better Bus Coalition
- Uptown Consortium
- UC

Who is the target audience?
- Residents, employees and patrons of uptown and downtown

What is the City of Cincinnati's role in implementation?

The City, in cooperation with stakeholders, will commission the feasibility study. The City will partner with stakeholders to build and operate the Downtown to Uptown Link.

Is it feasible?
- Feasibility: Hard
    - This is capital intensive but Cincinnati has routinely completed major transit improvements.

How much would it cost?

Cost	Benefit annual fare average	Cost-Benefit Ratio
See table, below (To transit authority)	$2,033,000 (To transit authority)	NA

Extension of a transit link to uptown is a cost intensive recommendation which has the potential to dramatically alter the ability of residents to easily travel across multiple neighborhoods in Cincinnati. This recommendation carries the potential to improve neighborhood connectivity between the Central Business District, Avondale, Clifton, Clifton Heights, University Heights and Fairview (CUF), Corryville, and parts of Mt. Auburn. A cost table estimate of various options is below:

Transit Mode	Construction Cost per mile	Miles Needed	Total Cost
Streetcar	10-25 million [1]	3	$30-75 million
Subway	100-1000 million [2]	1	$100-1000 million
Gondola	3-12 million [3]	1	$3-12 million
Aerial tram	57 million	1	$57 million
Bus/ Autonomous bus	NA	3	NA

Due to the highly variable costs it will be difficult to gain an accurate estimate until a feasibility report can be completed. Depending on the option selected, costs could range anywhere from $3 million to $1 billion. Assuming similar ridership to the Streetcar at the average of the two fare options ($1.50) we can estimate that annual fares will be roughly $2,033,600. This analysis does not attempt to factor in potential property value shifts, a potential for sustained increase in ridership or the significant business opportunities that the transit link provides.[173,174,175]

Keys to Equity

Regardless of the transportation mode selected, fares must be set at an affordable price, or some accommodation must be made to make mobility affordable for all.

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[173] (Reconnecting America)
[174] (Pedestrian Observations, 2011)
[175] (Grabar, 2013)

Timeline for Implementation
- Feasibility Study: 1 year
- Construction: 3-7 years, depending on mode.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
0 mtCO$_2$e	2,482 mtCO$_2$e	2,482 mtCO$_2$e

Using an average estimated fuel efficiency for existing vehicles of 22 miles per gallon (the average fuel economy of cars and light trucks in the US in 2015), the US EPA conversion factor of 8.89 x 10^3 metric tons CO$_2$ per gallon of gasoline, and a conversion factor for CH$_4$ and N$_2$O emissions emitted from tailpipes, we estimated that each personal car mile avoided by using the transit link would prevent 0.4 kg of CO$_2$e emissions.

Assuming 10,000 rides per day, 365 days per year, with 1.7 mile of driving avoided each trip. 6,205,000 vehicle miles avoided will save 2,482 mtCO$_2$e per year.[176]

11. Implement and update 2010 Cincinnati Bike Plan and Cincinnati Riding or Walking Network (CROWN) Plan.

What is it and why is it important to Cincinnati?

The 2010 Cincinnati Bike Plan was created by the Department of Transportation and Engineering, to outline projects that would make Cincinnati a bike friendly City. Biking offers a healthy, economically responsible, and environmentally friendly alternative to driving a car. One of the biggest problems with the City's existing bike infrastructure is a lack of connectivity between the different trails and routes. This lack of connectivity discourages biking as a viable mode of transportation in Cincinnati.
In 2015 the transportation sector made up 31% of Cincinnati's carbon emissions. One important step in becoming a greener city is improving alternative types of transportation, giving people an option other than simply driving their car. The 2010 Bike Plan lays out a framework to improve and implement bike paths, bike lanes, and sharrows (shared lanes for bikes and cars). Key elements of the Bike Plan include:

- mapping out an integrated on-street and off-street bikeway network
- describing the bicycle facilities that will make up the network
- addressing bicycle parking needs
- stressing safety education for motorists, bicyclists and youth
- providing an action plan for encouragement and enforcement
- recommending transportation and development policy changes
- identifying how bicycle use should be integrated into new rail transit systems that

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[176] (U.S. EPA, 2017)

are being planned
- providing guidance regarding street maintenance and management practices.

Cincinnati is home to many beautiful parks and many unique business districts, providing an opportunity for an interconnected biking system in the City. Updating and implementing the 2010 Bike Plan would help Cincinnati strengthen its transportation network and offer its residents an economic and healthy way to get from place to place.

Examples in Cincinnati and Peer Cities
- Cincinnati Bike Plan**,** https://www.cincinnati-oh.gov/bikes/bicycle-transportation-plan/
- Cincinnati Riding or Walking Network (CROWN), https://greenumbrella.org/TriStateTrails-CROWN

Who will be taking the leading roles on this project?
- Department of Transportation and Engineering
- Tri-State Trails

Who is the target audience?
- Cincinnati residents
- Bikers
- Walkers

What is the City of Cincinnati's role in implementation?

The City will organize local partners and lead implementation of the 2010 Bike Plan.

Is it feasible?
- Feasibility: Medium - Cincinnati has experience building bike and pedestrian infrastructure. The challenges will come in securing funding and building community consensus for each construction project.

How much would it cost?

	Cost	Benefit	Cost Benefit Ratio
Bike Plan (Phase 1)	$ 12,172,817 (To City of Cincinnati)	$928,125 (To Public)	11.5-year payback
CROWN Plan	$ 50,700,000 (To City of Cincinnati)	TBD (To Public)	TBD

The 2010 Bike Plan estimates that Phase 1, including 103 miles of bike lanes and paths, would cost $12.12 (adjusted by CPI to inflation, February 2018, from 2010 study) million and would double the number of bicycle commuters. 675 additional commuters at 2,500 miles per year and $0.55 per mile in avoided automobile costs would save $928,125 per year.

The CROWN system plan benefits from the fact that 70% of the mileage is already in construction and it will only take minor renovation to these portions to bring it together. The key to connectivity is the Urban Trail Loop. It would cover 30 miles (9 of which are complete), would be easily accessed by 242,000 people and cost $45.7 million. CROWN highlights another 39 miles of neighborhood arterial connections that are needed.[177] Since these are connectors, not the trail itself, they could be on-road bike lanes. A five-foot bicycle lane average cost is $130,000 per mile.[178] In total, these arterial connectors will likely cost another $5 million. Together the CROWN completions plus arterial connectors should cost approximately $50.7 million.

Studies show that trails have a large benefit. Maryland found a ratio of trail associated tax revenues to maintenance of 1.5:1. Trails can also abate costs by serving utility needs. 40% of rail trails in America generate funding this way.[179] Improved property values are commonly cited. A study of 1762 houses within 10000 feet of the Little Miami Scenic Trail found home buyers were willing to pay $9000 more to live within 1000 feet of a trail.

Keys to Equity

A comprehensive network of biking and walking paths will allow Cincinnati residents to safely travel from one place to another without the need of a car. Walking and biking is a cost-effective way to get around town and encourages residents to be active. Safe biking lanes will also allow people to commute to a job without the worry of competing for space on the road with cars.
- Special attention must be paid to biking infrastructure for disadvantaged communities.

Timeline for Implementation
- 3-5 years
    - Cincinnati is currently expanding their trail network with projects such as the CROWN plan. Partner organizations will continue work on many of these projects with more planned to start in 2018. However, additional funding will be needed to get the 2010 Bike Plan and CROWN fully implemented.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

	2018	2023	2050
2010 Bike Plan	0 mtCO$_2$e	709 mtCO$_2$e	709 mtCO$_2$e
CROWN	0 mtCO$_2$e	1,050 mtCO$_2$e	1,050 mtCO$_2$e

Cars emit 4.2 mtCO$_2$e per 10,000 miles traveled. We assume Phase 1 of the 2010 Bike Trail would create 675 additional bike commuters travelling 2,500 miles per year, reducing vehicle miles travelled by

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[177] (Green Umbrella, 2017)
[178] (Pedestrian and Bicycle Information Center, 2017)
[179] (Pennsylvania Land Trust Association, 2017)

1,687,500, and eliminating 625 $mtCO_2e$ per year. We assume CROWN, would produce an additional 1,000 bike commuters travelling 2,500 miles per year, reducing vehicle miles travelled by 2,500,000.[180][181]

12. Continue to support Red Bike (bike share) as an equitable mobility solution.

What is it and why is it important to Cincinnati?

Red Bike is Greater Cincinnati's bike share system that currently has 440 bikes spread across 57 locations providing Cincinnati residents with a fun and sustainable way to get around. The system had over 320,000 rides taken since it launched in 2014 and continues to grow and expand around the City. The current locations are primarily located in Downtown, The Banks, Over the Rhine, and Uptown, as well as across the river in Bellevue, Covington, and Newport.

The City of Cincinnati will work with Red Bike and other partners to continue Red Bike's growth in number of stations, bikes, and ridership. The City will support Red Bike's focus on increasing low-income access and ridership through the Red Bike Go Pass, which offers discounted memberships for low income residents to ensure they have equal access to the program, and to overcome participation barriers (like the requirement to have a credit card).

In addition, the City will work with Red Bike to deploy e-assist bike share bikes to increase the distance that riders can travel, minimize the impact of the regional topography, and decrease some physical barriers to using bicycles for transportation. Initial studies have shown that adding e-bikes to bike share fleets increases the average distance of rides and the average age of riders. The City will also work with Red Bike to explore dockless bike sharing programs to complement the current point to point bike share program.

A successful bike sharing program reduces greenhouse gas emissions in the City, provides a healthy mode of transportation, and creates economic opportunities for residents by connecting neighborhoods with the City's business districts.

Case Study: Cincinnati Red Bike

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[180] (U.S. EPA,
[181] (U.S. EPA,

Providing the City nearly 500 bikes across 57 stations, RedBike has been a key component of sustainable transportation in Cincinnati. They have been able to attract nearly 50 thousand unique users and have assisted in the burning of 36 million calories. Redbike ridership has been able to offset over 860,000 pounds of CO2 emissions and continues to do so.

Examples in Cincinnati and Peer Cities
- Philadelphia, PA and San Francisco, CA
    - Several cities have had some success with bike share equity programs, including Indego30 Access Pass in Philadelphia; and the Bike Share for All by Ford Go Bike in San Francisco.

Who will be taking the leading roles on this project?
- Red Bike

Who is the target audience?
- Workers in the urban core
- Residents in the urban core
- Low income residents

What is the City of Cincinnati's role in Implementation?

The City of Cincinnati will work with Red Bike to identify locations and funding sources for Red Bike expansion. The City will also work with Red Bike to promote the Red Bike Go Pass in low-income communities and with key social service agencies.

Is it feasible?
- Feasibility: Medium
    - Red Bike has been a very successful bike sharing program, but it can be difficult to change the habits of residents. This is especially true in low-income communities, where residents are not accustomed to using bicycles as transportation.
- Obstacles:
    - Red Bike locations are currently located in high density areas where they get the most traffic, but those locations are not always the best when trying to establish an equitable system. It will require careful planning to ensure that stations are placed in spots where they will be used regularly.

How much will it cost?

Cost of 20% system expansion	Benefit: 20% program revenue expansion	Cost-Benefit Ratio (5 year)

TBD	TBD	TBD

Keys to Equity

Biking is a cost-effective way to get from one place to another, while also getting in some exercise. Bike sharing can provide residents with a reliable source of transportation right in their neighborhoods. With a cost-effective model, bikeshare save low-income residents money and offer them alternative modes of transportation that may be quicker and easier to use than other public transit options.

Timeline for Implementation
- 1 - 3 years
  - The City has worked with Red Bike to implement the service and will continue with this partnership to expand the existing services and put a special focus on low income residents.

Greenhouse Gas Impact

Annual Carbon Reduction Potential

2018	2023	2050
12.6 mtCO$_2$e	63 mtCO$_2$e	403.2 mtCO$_2$e

If Red Bike grows by 20,000 rides per year and the average ride is 1.5 miles, and cars emit 4.2 tons of CO$_2$ per 10,000 miles travelled, this recommendation will avoid 12.6 tons in year 1, and an additional 12.6 tons per year for each subsequent expansion.

WASTE

Reducing, reusing, recycling, and minimizing the impact of what has been discarded

From 2010-2015, the amount of waste landfilled by Cincinnati residents decreased by 28%, or 24,133 tons. This was accomplished thanks to the individual efforts of residents, increased awareness about recycling and waste reduction, and strong public/private partnerships. During this time, Cincinnati continued its commitment to curbside recycling and keeping residential yard trimmings out of the landfill. The City partnered with private sector recyclers to collect items such as electronic waste and textiles and supported Hamilton County Recycling and Solid Waste District's efforts to help businesses set up waste reduction and recycling programs. As we celebrate our successes, we on the Green Cincinnati Plan Waste Task Team know we can continue to divert more material from our landfills.
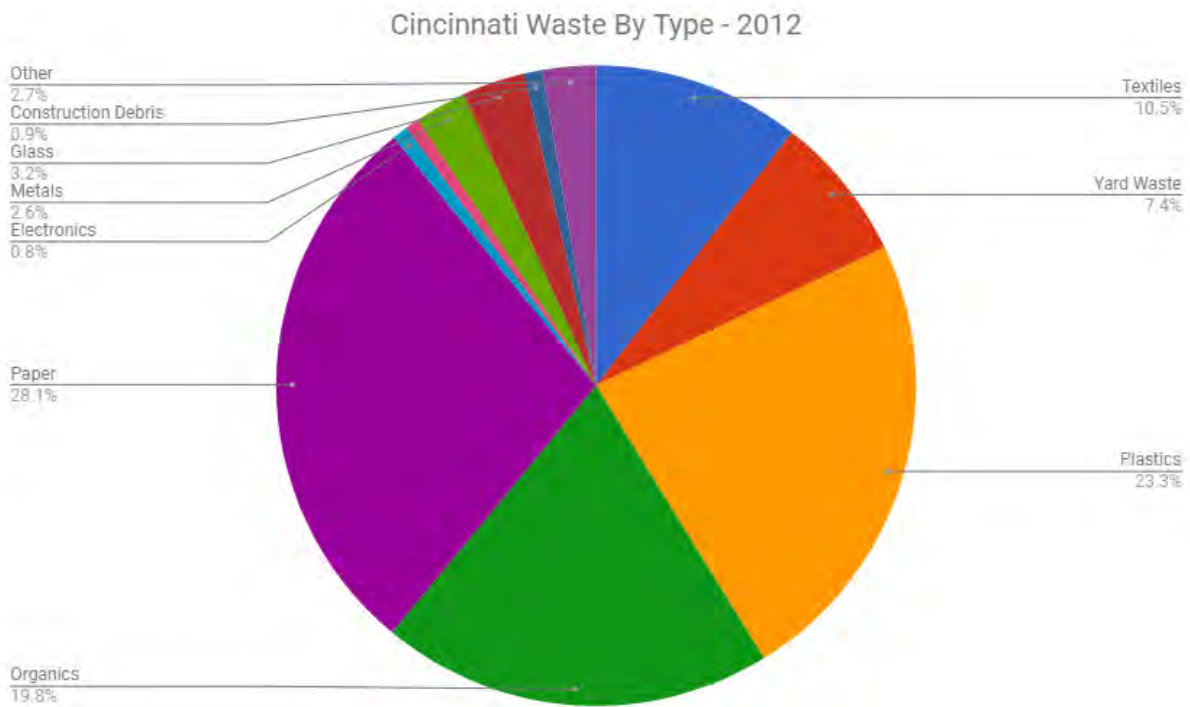
It's hard to believe that food is the nation's number one material landfilled. And, on a local level, more than 60 percent of what residents throw away can be recycled in Cincinnati's curbside recycling program or composted in the backyard. With this knowledge, the Waste Team developed a series of recommendations aimed at decreasing the amount of waste sent to landfills and increasing curbside recycling participation in all neighborhoods with the ultimate goal of generating zero waste by 2035.

Achieving these goals will be no easy task. We need residents, businesses, City staff, and our partners all rowing in the same direction. As you read through our recommendations, ask yourself how and where you can help. Can you talk with your neighbors about what can be recycled? How about improving your business' recycling program? Do you live in or own an apartment building where you could start a recycling program? What about learning how to start composting food scraps in your backyard? The City and its partners can help you get started.

We are excited about Cincinnati's successes and, more so, about Cincinnati's future. We can't wait to see the results of all of our efforts.

Goals

1) ZERO WASTE BY 2035.

Cincinnati Waste By Type - 2012

Other 2.7%
Construction Debris 0.9%
Glass 3.2%
Metals 2.6%
Electronics 0.8%
Paper 28.1%
Organics 19.8%
Textiles 10.5%
Yard Waste 7.4%
Plastics 23.3%

Through the Office of Performance & Data Analytics the City tracks and displays recycling, landfill, and waste type data and the data are updated to show recycling participation activity on a monthly basis. Citation: City of Cincinnati Performance & Data Analytics, 2017.

2) DECREASE (RESIDENTIAL) TONNAGE TO LANDFILL BY 20%.

Tons of Recycling and Landfill Waste by Year

Through the Office of Performance & Data Analytics the City tracks and displays recycling, landfill, and waste type data and the data are updated to show recycling participation activity on a monthly basis. Citation: City of Cincinnati Performance & Data Analytics, 2017.

3) INCREASE PARTICIPATION IN CITY CURBSIDE RECYCLING PROGRAMS BY 5% FOR RESIDENTIAL AND 20% FOR COMMERCIAL.

City of Cincinnati Recycling Participation Rate by Neighborhood
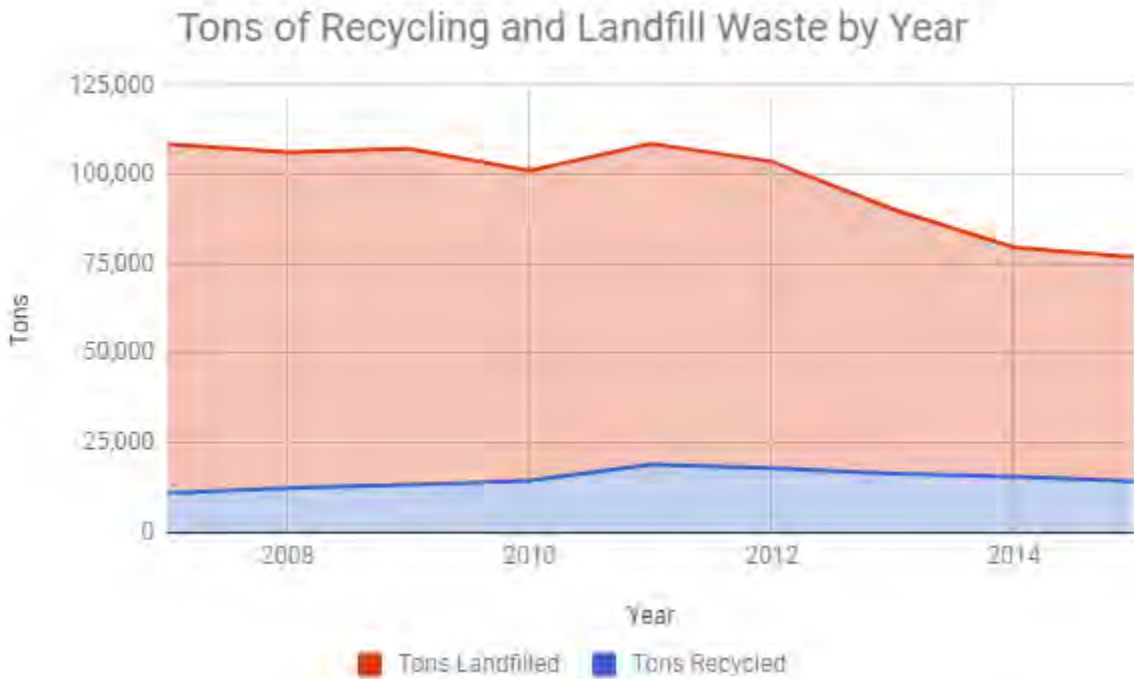
Through the Office of Performance & Data Analytics the City tracks and displays recycling, landfill, and waste type data and the data are updated to show recycling participation activity on a monthly basis. Citation: City of Cincinnati Performance & Data Analytics, 2017.
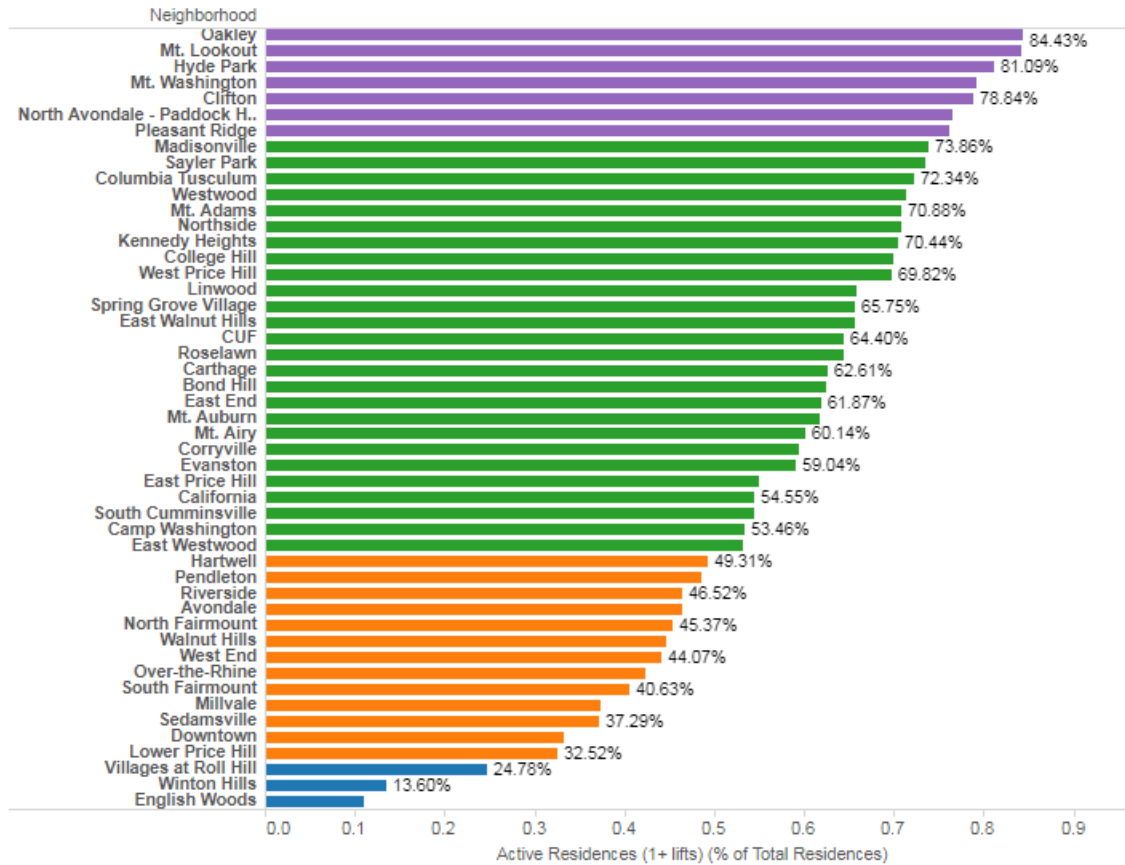
Recommendations

Many of the recommendations of this plan are inter-related, and have multiple benefits. For additional recommendations related to Waste, please see:

- *Food #1: Encourage individuals and companies to prevent, recover, and recycle wasted food.*
- *Resilience #11: The City should develop an Environmental Justice program that identifies communities that are disproportionately burdened by pollution (and hazardous wastes), and acts to reduce or eliminate those burdens.*

1. Incentivize recycling and increase cost of trash generation to encourage diversion from landfill.

What is it and why is it important to Cincinnati?

According to the most recent waste audit, 63.4% of the materials that are sent to the landfill in Hamilton County could have been recycled or composted. Waste diversion represents a major opportunity to more efficiently use our natural resources, and a potential source of economic savings for businesses. While Cincinnati is fortunate to have affordable waste disposal options, the low cost does not create much incentive for residents, businesses, or other organizations to reduce the amount of waste they generate. Incentivizing recycling and increasing the cost of waste disposal will encourage more efficient use of resources.

Strategies to encourage recycling and increase the cost of waste generation may include:

- **Implement variable rate pricing for trash collection.**

  The City of Cincinnati provides trash collection to residents at no cost. This gives residents no incentive to reduce the amount of trash they generate, and no understanding of the environmental and financial cost of wasting resources. Variable rate pricing for trash rewards residents who recycle and reduce the amount of waste they generate with lower bills for trash collection. PAYT trash systems charge residents for trash collection, and charge an amount that increases as the volume of trash increases.

  Adoption of variable rate pricing in Cincinnati would require a vote by the citizens. If residents are allowed to set out 1 trash cart each week for free, and are required to pay for additional trash removal, most households will still enjoy free trash collection, but unusually wasteful households will pay the costs of their waste. A consideration will be made for low income large households who may be unable to reduce their waste to one trash can and unable to afford the cost of paying for an additional trash receptacle. Considerations must be made for these circumstances to avoid an increase in illegal dumping and littering.

  Examples in Peer Cities:
  - Grand Rapids, MI
  - The City of Grand Rapids measures individual output of trash generated from each household with a chip installed in each city trash can. The residents' trash rates are then charged based on the amount of waste they generate.

- **Increase commercial waste collection fees in the City of Cincinnati. Offer programmatic support to help businesses reduce waste.**

In 2013, the City of Cincinnati passed an ordinance requiring all commercial waste haulers to have a franchise agreement with the City. Part of this system is a fee which the City charges the waste haulers for any waste collected from a commercial building and taken to a solid waste facility.

The waste collectors incorporate the costs of the fee as part of their pricing system charged to the waste generator. The City should increase the franchise fee from 10% to 20% of gross revenue of the waste generator. Increasing the fee will increase costs on waste generators in Cincinnati, creating an incentive to minimize waste. To assist businesses in making the behavioral changes to reduce their waste generated, the City will offer programmatic support. The fee is not charged on any waste sent to a recycling facility, so creating a comprehensive recycling program can help organizations reduce their monthly bill.

Potential revenue the City generates from the program could be used to establish the programming and incentives needed to help businesses make a smooth transition. It is expected that this program encourages businesses to invest in smarter waste management systems, effective recycling programs, and creates an opportunity for them to reduce their costs of waste disposal. It also promotes sustainable practices for those working, living, or visiting in these commercial spaces. Increasing Cincinnati's franchise fee for waste collection will encourage any organization operating in a commercial space to make the transition to sustainable waste management practices.

Examples in Cincinnati and Peer Cities
- Cincinnati, OH
  - The City of Cincinnati has a franchise fee for commercial waste haulers of 10%.

- **Require recyclable items to be recycled.**

Mandate that homes and businesses do not place recyclables, such as paper, cardboard, aluminum, glass and plastic in the trash can. Violators with recyclables found in their trash will be issues a warning. Repeat offenders will be issued a fine.

Examples in Peer Cities:
- Pittsburgh, PA
  - City code requires "All residents of the City of Pittsburgh must separate recyclable items from household trash and package them for bi-weekly recycling curbside collection."
  - http://pittsburghpa.gov/dpw/environmental-services/residential-recycling.html

Who will be taking the leading roles on implementation?
- Environmental Organizations
- Department of Public Services

What is the City of Cincinnati's role in implementation?

- The City of Cincinnati will explore mandatory recycling policies.
- The City of Cincinnati will implement variable rate pricing for trash collection if directed to do so by the voters.
- The City of Cincinnati will increase the franchise fee. The City will also work to ensure that some of the money collected from the fee goes back into the program to provide businesses the support needed to reduce their waste.

Who is the target audience?
- Waste generators:
  - Households
  - Businesses/organizations that uses a commercial waste hauler

Is it feasible?
- **Variable Rate Pricing for Trash**

  - Feasibility: Hard
    - There is an economic incentive for Cincinnati residents to implement a variable rate pricing system. The City will benefit from less waste being sent to the landfill and the economic opportunities created by recycling and repurposing of waste.
  - Obstacles:
    - Voters must support a fee for a service they currently receive for free.

- **Increased Commercial Waste Fee**
  - Feasibility: Medium
    - The franchise fee is already in place. There is no barrier to adjusting the amount of the fee.
  - Obstacles:
    - A wide range of businesses of varying sizes use commercial waste haulers. Some may object to the fee increase.
    - It will be difficult to create programming that effectively reduces waste for each individual business.

How much will it cost?

	Cost	Benefit	Cost-Benefit Ratio:
Variable Rate Pricing for Trash	TBD (To waste generators)	$ 1,100,000 (To City)	TBD
Commercial Waste Fee	TBD (To businesses)	TBD (To City)	TBD

There is no cost to the City involved in increasing the commercial waste fee. If the amount of waste generated does decrease (as intended), the rise in fees will not yield a rise in aggregate fee revenues. There would be additional cost to waste generators.

Evaluating a variable rate pricing system is difficult due to the many ways this system could be structured. Costs will include personnel to manage establish service levels and manage changes for each structure, plus a billing and collection system, which will probably piggyback on an existing system such as water bills. Benefits are not possible to quantify until the City sets a fee schedule. Given most residents use a City issued 64-gallon trash receptacle, the base level of service is likely to be set at 64 gallons per week. A second container might be issued to a household for a monthly charge of $8. It is expected that about 10% of households will accept the second container. 9,000 households paying $8/month would raise about $900,000. If residents also reduced their trash generation by 10%, the avoided landfill disposal fees would save the City about $200,000. [182]

Keys to equity

Increases in cost to generate waste must be implemented in a way that encourages waste reduction and/or increased recycling. Fees must be set in a way that does not excessively burden low income households or small businesses.

Timeline for implementation
- **Variable Rate Pricing** Expected: 3 - 5 years
  - A variable rate pricing system must be adopted by voters. Following a successful ballot issue, time will be needed for implementation.
- **Franchise Fee** Expected: 1 - 2 years
  - A fee increase must be adopted by City Council. With a franchise fee already in place, it will not take the City long to implement an increase.

Greenhouse Gas Impact

Annual Emissions Reduction Potential

	2018	2023	2050
Variable Rate Pricing	0 mtCO$_2$e	77,733 mtCO$_2$e	77,733 mtCO$_2$e
Commercial Waste Fee	0 mtCO$_2$e	19,609 mtCO$_2$e	19,609 mtCO$_2$e

Based on a US EPA study[183], variable rate pricing programs reduce greenhouse gas emissions by .343 tons per capita. According to the 2006 US Census, the average household size in Cincinnati is 2.18. Multiplying 2.18 by 104,000 households that are eligible for Cincinnati's waste collection is equal to 226,720 people. Multiplying 226,720 by .343 tons equals 77,733 tons.

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[182] (U.S. EPA, 2017)
[183] (U.S. EPA, 2003)

In 2015, commercial waste generation in Cincinnati generated 196,091 mtCO$_2$e. We assume an increased commercial fee will help divert 10% of commercial waste to recycling over 5 years.

2. Divert organics from the landfill.

What is it and why is it important to Cincinnati?

Cincinnati currently disposes most of its food waste and other organic waste to the landfill. In the landfill, this organic material is broken down and creates methane which is a potent greenhouse gas. In Cincinnati, some of this methane is recaptured from the landfill for reuse as natural gas.
Organic waste is any type of waste that is either plant or animal based, meaning the product comes from a living organism, and includes any type of food waste. Organic waste can be broken down and used to create energy making it a valuable resource that oftentimes ends up wasting away in the landfill. Reducing and reusing organic waste is addressed in the Food Chapter but this recommendation focuses on the recycling of organics through the following strategies:

- Anaerobic Digestion
- Commercial Composting
- Backyard & Neighborhood Composting

Anaerobic digestion offers an alternative that creates economic opportunities while keeping waste out of the landfill and methane out of the atmosphere. Anaerobic digestion is an enclosed system that rapidly breaks down organic waste using high temperatures and bacteria. These bacteria produce biogas (natural gas) which is captured to make energy. The solid material left over is a valuable fertilizer that can be used by farmers and gardeners.

There are currently few facilities in Cincinnati accepting organic waste. This is largely because of the low cost of tipping fees at local landfills which make is harder for composting and anaerobic digester facilities to implement financially viable systems. To make these facilities financially viable, the City will work with local stakeholders to identify sources of funding for one or more of these facilities in the region. Considerations must be made for the location and surrounding neighborhoods, the cost of transportation, and partners who can use the by-product created by these facilities which is a fertilizer that can be used by farms and community gardens. These facilities would greatly reduce the amount of organic waste going to Cincinnati landfills and create economic opportunities from that waste.

Smaller scale opportunities for reducing organic waste may include efforts to encourage backyard composting, and utilizing community gardens for composting. Food waste reduction and recovery will be key for reducing organic waste to landfill. These strategies are outlined as food recommendations.

Examples in Cincinnati and Peer Cities
- **Columbus, OH**
  - The City of Columbus has contracted the largest anaerobic digester in Ohio, accepting waste from the City's wastewater treatment facilities, OSU, and other local partners, providing compressed natural gas for City vehicles.
- **Cleveland, OH**

- ○ The City of Cleveland has contracted an anaerobic digester that helps divert organic waste from the Cleveland Browns' stadium, local wastewater treatment plants, and other local partners.

Who will be taking the lead roles on this project?
- Local food processors
- Local breweries
- Local producers of organic sludge
- Organic waste management company

What is the City of Cincinnati's role in implementation?

The City of Cincinnati will partner with local waste producers to attract an organic waste management company to our region. The City will encourage the siting of one or more anaerobic digesters and composting facilities in the Cincinnati region through financing, incentives, and/or organizational support.

Is it feasible?
- Feasibility: Hard
  - ○ The Southwest Ohio region has very low cost to send material to the landfill. With low landfill costs, it is difficult to make organic waste facilities financially viable. Other challenges include difficulty in aggregating sufficient quantities of organic waste to serve as feedstock, and difficulties finding suitable sites near the city.
- Obstacles:
  - ○ To make organic waste facilities viable in southwest Ohio, a willing investor must provide the upfront costs and ensure they have a reliable market for the energy and the fertilizer resulting from the process. The company must find a steady stream of organic waste from a reliable source that isn't heavily affected by seasonal changes.

How much will it cost?

Cost	Benefit	Cost-Benefit Ratio: 8 year
$65 million to $71 million (To Anaerobic Digester investors).	~12% ROI/average (To Anaerobic Digester Investors).	1:1

In 2016, a feasibility analysis estimated that a fully enclosed anaerobic digestion facility would have approximate lifecycle cost of $65-71 million.[184] One of the advantages of biogas technology is the ability to recycle and resell it. The ROI is highly variable based on net production and how the energy is distributed but common ROI citations of biogas plants are in the range of 11.4%-13.8% on an annual basis[185]. At an average 12% ROI it would take 8.3 years to recoup costs. Break even points are reasonable for this type of initiative, often below 20 years, sometimes as few as 4-5 years (100KW plants). These are also highly dependent on plant size; larger investment in size and management has shown to lower time necessary to recoup costs[186].

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[184] (City of Cincinnati, 2016)
[185] (Meyer & Lorimor, 2003)
[186] (Carlini, 2017)

Keys to Equity

Site selection of an anaerobic digester or composting facility should be sensitive to the surrounding community, and work to minimize odor and the impact of truck traffic. The City will work to help ensure that any AD located within the City of Cincinnati will have an odor management plan.

Timeline for Implementation
- 2 - 4 years
- The City of Cincinnati currently has some organic waste collectors, but most organic waste ends up in the landfill. A new organic waste facility will require feedstock agreements from local waste producers and the construction of the facility itself.

Greenhouse Gas Impact

Annual Emissions Reduction Potential

2018	2023	2050
0 mt CO_2e	41,649 mt CO_2e	41,649 mt CO_2e

An average sized anaerobic digester can process 25,000 tons of organic waste per year. 1 ton of food waste in a landfill produces 1.72 $mtCO_2$e. GHG emissions from solid waste totaled 210,348 $mtCO_2$e in 2015. A 2012 waste audit reported 19.8% of Cincinnati's solid waste consists of organic matter (paper was counted separately). By 2050, we assume we can divert 100% of organic waste from the landfill.[187] [188]

3. Attract credible manufacturers that make products from recycled materials to increase the types of materials that can be accepted in curbside recycling program.

What is it and why is it important to Cincinnati?

The City of Cincinnati's recycling program is conducted by Rumpke. Currently they collect plastic bottles and jugs, glass and metal containers, paper, cardboard, and cartons. What can and cannot be recycled in Southwest Ohio is determined by which items can be sorted by the Material Recovery Facility and what items can be resold into local markets. On average, sorting and processing recyclables creates 10 times as many jobs as landfill disposal and even more jobs are created when that product is reused.

To expand the number of acceptable items at the Rumpke recycling facility, a market must be created in our region. To create a market, that means the City must attracting new and innovative businesses to our region that can use the recycled material to make their products. The City will look at tax codes and zoning laws to identify ways they can make it easier for existing and new businesses to use recycled

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[187] (Watch My Waste, 2017)
[188] (City of Cincinnati, 2018)

material to make products. The City will work with Rumpke, the City's recycler, to connect businesses with recycled material they may be able to use. For Rumpke, this will help them attract new customers and expand their recycling program. For the City, the promotion of this industry will keep recyclable materials out of the landfill, create jobs, and attract new businesses.

Creating these markets will incentivize Rumpke to expand their business and accept a wider range of materials, keeping that material out of the landfill. Throughout this process, the City will continue to educate residents of what can and can't be recycled and the importance of their participation in the recycling program. The City will work to recognize those businesses that use recycled materials to help them attract a wider range of customers and gain recognition in the city. Expanding the City's recycling program will create new jobs, economic opportunities for businesses, and keep additional waste out of our landfills.

Examples in Cincinnati and Peer Cities
- Cincinnati, OH
  - Curbside Textile Recycling – In 2017, Cincinnati partnered with Simple Recycling to offer curbside textile recycling pickup
  - http://simplerecycling.com/

Who could help implement this project?
- OES
- Rumpke
- Regional Economic Development Initiative
- Department of Community and Economic Development

Who is the target audience?
- Rumpke
- Companies that use recycled materials

What is the City of Cincinnati's role in implementation?

The City of Cincinnati will partner with other entities to identify and recruit businesses that can utilize components of the waste stream.

Is it feasible?

- Feasibility: Hard – Few case studies have been identified of cities recruiting businesses to make products from municipal solid waste.

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio
Nominal, Administrative (To City of Cincinnati)	TBD (To prospective partners)	TBD

It is likely that the City will incur little expense to expand the stream of recyclables. The most direct expense to the City will be in time devoted from program managers on both courting businesses and assisting them to set up operations which can be accomplished partially in collaboration with Rumpke and/or another public-corporate partnership. Once pilot programs are developed and operating at full scale it is likely that there will be some operational kinks which the City staff will have to assist in working out.

This recommendation has potential to attract valuable business and employment to the City while more properly managing our waste stream. Since few case studies have been found of a City recruiting a business to make products from trash, any estimate of job creation and tax revenue would be pure speculation.

Keys to Equity

- Businesses that make products from wastes should not produce other unwanted effects in disadvantaged communities, such as pollution or excess trucking traffic.
- Facilities should be located near transit lines so that people who don't own cars have an opportunity to compete for jobs.

Timeline for Implementation
- 3-5 years
    - To attract new businesses, the City will first need to identify what materials are currently going to the landfill that could be used by a company to make a product. Once these waste streams are identified, the City can work to attract businesses who may be able to use that material. First steps will be looking at the City's existing policies and ensuring that they support businesses looking to use recycled material.

Greenhouse Gas Impact

Annual Emissions Reduction Potential

2018	2023	2050
0 mtCO$_2$e	21,348 mtCO$_2$e	21,348 mtCO$_2$e

251

In 2015, commercial and residential waste generation in Cincinnati generated 210,348 mtCO$_2$e.[189] We assume the expansion of the recycling program could reduce landfilled waste by 10% over 5 years.

4. Advertising and outreach to improve recycling rates - spending $1/household/month - Focus efforts on currently lower performing communities.

What is it and why is it important to Cincinnati?

The City of Cincinnati currently has about 70% of its population participating in its recycling program. To increase the participation rate, the City should invest $1 in advertising every month for every household that is eligible to participate in recycling. This ensures that there is a steady stream of funding for advertising and outreach for the recycling program that is proportionate to the number of individuals participating.

The largest barriers keeping people from recycling are the perception that recycling is difficult, uncertainty about what can and can't be recycled, and lack of motivation. Cincinnati provides recycling service and carts to its residents at no additional cost, making it easy to recycle in the City. Despite this, not everyone is aware of how easy the process is. Some residents do not see the point of recycling, making them less likely to do it. To expand the current program, the City must make it clear how easy it is to recycle in Cincinnati and educate residents of the economic and environmental benefits from a successful recycling program.

Outreach efforts in low-income neighborhoods are especially important because this is where recycling rates are the lowest. It is important to work with property owners to ensure that their tenants have adequate recycling carts. The funding for education and outreach will help Cincinnati keep recyclables out of the landfill.

Examples in Cincinnati and Peer Cities
- Columbus, OH
  - The City of Columbus has a targeted education program to increase recycling rates in low performing neighborhoods to achieve a 35% diversion rate for the entire City.
  - https://www.columbus.gov/getgreen/Key-Initiatives/

Who will take the leading roles on this project?
- Office of Environment and Sustainability
- Rumpke
- Hamilton County Solid Waste District

Who is the target audience?
- Cincinnati residents - especially those in neighborhoods with low recycling rates
- Landlords and building managers

What is the City of Cincinnati's role in implementation?

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[189] (City of Cincinnati, 2015)

The City of Cincinnati will help increase the rate spent on recycling advertising and outreach from $1/household annually to $12/household annually. The City will work with Rumpke Recycling to expand existing outreach programs and increase programming in neighborhoods with lower recycling rates.

Is it feasible?
- Feasibility: Medium
  - The City already has recycling outreach programs in place which can be expanded with additional funding.
- Obstacles:
  - Securing additional funding may be difficult with an already tight City budget. To implement a successful program, outreach messages should be tailored to the specific problems facing each neighborhood, requiring different messages to be sent out to different neighborhoods.

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio
$1.03 million (To City of Cincinnati)	TBD (To City of Cincinnati)	NA

There are 86,000 households that are eligible to participate in the City's recycling program. To spend $12 per year on these households would cost $1.03 million.

Keys to Equity

Currently about 70% of Cincinnati residents participate in the City's recycling program. The neighborhoods with the lowest recycling rates are also some of the poorest neighborhoods in the City. However, a successful recycling program creates jobs and economic opportunities. Recycling programs attract industries looking to use the recycled material to make new products, bringing new jobs to the City and strengthening the local economy.

Landlords of multi-family dwellings will have the opportunity to save money by encouraging their tenants to recycle. The price to send material to recycling facilities are lower than the cost of sending material to the landfill. By offering some basic incentives, landlords can get widespread recycling participation in their buildings and save themselves money.

Timeline for implementation
- 1 - 2 years
  - The City already has recycling outreach programs in place that can be expanded once additional funding is secured, ensuring this recommendation can be quickly implemented.

Greenhouse Gas Impact

Annual Emissions Reduction Potential

2018	2023	2050
0 mtCO$_2$e	21,348 mtCO$_2$e	21,348 mtCO$_2$e

In 2015, commercial and residential waste generation in Cincinnati generated 210,348 mtCO$_2$e. [190] We assume marketing efforts to promote the benefits of recycling could reduce landfilled waste by 10% over 5 years.

5. Create recycling and reuse outlets to recycle items that cannot be accepted by the curbside program.

What is it and why is it important to Cincinnati?

The City of Cincinnati contracts with Rumpke to provide the curbside recycling program in Cincinnati. This program has allowed Cincinnati to greatly increase the amount of recycling it collects, but only certain materials are accepted curbside. Rumpke only picks up material that it can resell to another company for a profit. Some materials are not accepted in the curbside program because there is no market for them in or around southwest Ohio. Other items are not accepted because they contain hazardous materials (batteries/electronics), are too fragile (light bulbs/CFLs), interfere with automated sorting equipment (sheet plastic, plastic bags, clothing, scrap metal), or get sorted incorrectly by automated equipment (aluminum foil/aluminum trays). There are occasional collection events for these "hard to recycle" materials, but mostly they end up in the landfill, despite the existence of willing buyers. The City of Cincinnati will pursue one of the following strategies to keep those hard to recycle items out of the landfill: create recycling centers at convenient locations that accept recyclable materials not collected curbside.

- Create recycling centers at convenient locations around the City that accept materials not accepted curbside.
- Host special recycling events throughout the year for Cincinnati residents to dispose of their hard to recycle items.

These recycling centers will be secured locations where residents can come to drop off recyclable materials that are not accepted curbside. This gives people a reliable place to take their hard to recycle items at any time, within normal business hours. The City will develop procedures to ensure that these locations do not become illegal dumping grounds for other types of waste, a problem peer cities have experienced with these programs. The City will implement educational/outreach programs for residents to educate them on what types of materials can be collected by these centers and why they should take hard to recycle material there instead of sending it to the landfill. who use the recycling centers to get a clean stream, meaning they receive mostly recyclable material and not trash. Recycling centers would also create jobs, both at the centers, and in businesses that use the recycled materials as feedstocks.

Recycling events are one-day programs in which the City will work with partner organizations to collect specific hard to recycle items. It is important that outside organizations are brought in to ensure a wide range of hard to recycle materials can be collected and to ensure those materials are being put to a god

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[190] (City of Cincinnati, 2015)

use, and not simply ending up in the landfill. Recycling events are expensive to put on, but avoid the risks of illegal dumping that recycling centers face. Recycling events, even if put on multiple times a year, require residents to save their hard to recycle items until the next event, something some residents will be unwilling to take the extra time to do.

A critical aspect of this recommendation program is finding a buyer to take home the recycling once it is collected. The City will only collect materials for which there is a market. In appropriate cases, the City may help to launch a business that uses collected materials as a feedstock.

The establishment of these recycling centers would allow residents who are active recyclers to take their efforts to the next level. For residents who are not avid recyclers, the recycling centers would be a place to bring a wide range of recyclable materials that might be difficult for the individual to sort through on their own. Recycling centers Programs for hard to recycle items would help reduce the amount of waste Cincinnatians are sending to the landfill and would encourage sustainable behaviors. Recycling centers would also create jobs, both at the centers, and in businesses that use the recycled materials as feedstocks.

Examples in Cincinnati and Peer Cities
- Houston, TX
  - The City of Houston has one of the most successful neighborhood recycling center programs in the country that has provided insights for both successful and unsuccessful centers.
  - http://www.houstontx.gov/solidwaste/depositories.html

Who will be taking the leading roles on this project?
- Office of Environment and Sustainability

Who is the target audience?
- All Cincinnati residents

What is the City of Cincinnati's role in implementation?
- The City of Cincinnati will be responsible for organizing resources and partners to implement a recycling program for materials not accepted curbside.

Is it feasible?
- Feasibility: Hard
  - The recyclable materials that are accepted curbside are accepted because there is an established market within the region for these materials. For items that are not currently collected, it may be difficult to find places that will take them within our region.
- Obstacles:
  - Care must be taken to avoid dumping at neighborhood centers. These facilities must be managed by trained staff that can handle material in accordance with EPA guidelines.

How much would it cost?

Cost Year One	Benefit	Cost-Benefit Ratio

$166,000 (To City of Cincinnati)	TBD (To City of Cincinnati)	NA

This program will start with one pilot recycling center. The cost to obtain and equip a site is estimated to be $125,000. The City will need to provide staff to ensure proper collection and operation. Assuming an average wage of $15/hour and these facilities operating 10 hours a day, 5 days a week for the equivalent of 50 weeks out of the year, labor should run roughly $40,000 annually. Assuming an average $1.30 in utilities per square foot annually we can estimate 400 square feet would cost roughly $520 to operate annually. Together first year costs run roughly $166,000. Much of what would be collected has market value but it is very difficult to estimate the value of each material which might be included, given these will only be collected once the City finds a suitable purchaser. Assuming in year one the City elects to construct and staff 1 center, the total cost would be $166,000.

Keys to Equity

Locate centers with easy access to public transportation. Ensure transportation associated with delivery does place undue burden on communities.

Timeline for Implementation
- 3-5 years

Greenhouse Gas Impact

Annual Emissions Reduction Potential

2018	2023	2050
0 mt CO_2e	6,161 mt CO_2e	6,161 mt CO_2e

EPA estimates 2.87 mtCO_2e per ton of waste recycled instead of landfilled. In 2016, Cincinnati residents recycled 21,468 tons. We assume this recommendation would increase residential recycling by 10%.[191]

6. Implement a special event recycling program. Require recycling at any events that require a City permit.

What is it and why is it important to Cincinnati?

Special events such as fairs, festivals, concerts, sporting competitions, conventions, reunions, weddings and other gatherings outside of the home happen regularly in Cincinnati. These gatherings of large groups of people often create large amounts of waste and often take place in spaces with inadequate or no recycling infrastructure. The City will encourage or require organizers of special events to offer recycling. To make special event recycling more successful, a Special Event Recycling Toolkit will be developed or an existing model will be adapted for Cincinnati. This tool-kit will set out guidelines on how

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[191] (Watch My Waste, 2017)

to successfully implement a recycling program for events around the City with links to resources and service providers that an event organizer might want to use.

Special event recycling programs provide a place to divert recyclable material, rather than allowing that material to go to the landfill. Successful implementation of these programs reduces the amount of waste generated by the event, and reduces the cost of taking that waste to the landfill. Event organizers will receive good publicity for their green efforts which may attract more people to the event.

The City will help to create the tool-kit and promote the importance of recycling programs for special events. The City will work with vendors and advocates to ensure that the guidelines pertain specifically to the Cincinnati region. Collaboration with waste haulers and waste collectors will be beneficial as these partnerships play a vital role in the success of the recycling programs. Volunteers and event staff also play a crucial role, making sure recycling materials goes into the right container, and a network by which to recruit volunteers and event staff will be established. Collecting these resources together into one tool-kit will provide an excellent resource to be used throughout the City.

Examples in Cincinnati and Peer Cities
- Flying Pig Marathon
    - The Flying Pig Marathon has developed a comprehensive special event recycling program that provides a model of success for other events.

Who will be taking the leading roles on this project?
- Office of Environment and Sustainability

Who is the target audience?
- All special events in Cincinnati

What is the City of Cincinnati's role in implementation?

The City has already developed a special event recycling program and will be responsible for enforcing that program for any event that requires a City permit.

Is it feasible?
- Feasibility: Easy
    - Since the City already has a special event recycling program, it is likely that they will be able to enforce it City-wide for all special events requiring a City permit.
- Obstacles:
    - Special events that are forced to bear the cost may be opposed as they are often operating with a limited budget.

Draft 2018 Green Cincinnati Plan

Case Study: Flying Pig Marathon

In addition to being one of the largest race events in the country, since 2009 the Pig has committed itself to being among the greenest race events in the country. The Pig has accomplished this through electronic bookkeeping and the Virtual Goodie Bag, which has allowed the Pig to remove over 2 million pieces of paper from the waste stream. The marathon holds a clothing drive, has implemented a food recovery program, and has managed to reuse signage and other materials. The marathon has recycled nearly all their disposable materials. In 2017 alone, Pig managed to divert 78% of all waste (10.77 tons); nearly a ton each of food composted and clothing donated and over one ton of food was recovered and donated. The Pig 'Green Zone' was also successful in organizing a carpool to ferry nearly 2000 participants and facilitated $610,000 in fundraising for neighborhood charities.

How much will it cost?

Cost	Benefit	Cost-Benefit Ratio
None	TBD (To waste collectors)	NA

Creation of the mandate and development of the waste management toolkit can be accomplished at little to no cost to the City and waste collectors. These items both require collaboration between the City and its partners to figure out the easiest method to provide adequate waste management at every event in the City. There may be some additional cost to the event, depending on scale, and amount of waste and recycling generated.

Keys to Equity

Options must be available for low budget events to provide recycling services themselves at little or no cost. The City will work with the Hamilton County Solid Waste District to ensure low budget events are able to implement recycling programs.

Timeline for Implementation

- Expected: 1 - 2 years
    - With a special event recycling program already developed, it will be fairly easy to begin implementing and enforcing the program.

Greenhouse Gas Impact

Annual Emissions Reduction Potential

2018	2023	2050
4,485 mtCO$_2$e	4,485 mtCO$_2$e	4,485 mtCO$_2$e

EPA estimates 2.87 mtCO$_2$e per ton of waste recycled instead of landfilled. Event participants are estimated to generate 2.5 pounds per person per day. We assume this recommendation will help 2,500,000 event participants recycle half of the waste generated. [192] [193]

7. Install public recycling receptacles in neighborhood business districts.

What is it and why is it important to Cincinnati?

Cincinnati is home to 52 unique neighborhoods, many of which have vibrant business districts that attract new residents to the City and strengthen our local economy. These business districts can be popular places on Friday and Saturday nights and even stay busy throughout the week. With many people coming in and out of the business districts on a regular basis, an effective system for collecting waste should be in place. The City already ensures that there are garbage containers within these business districts, but very few of these areas have adequate recycling bins.

The City will ensure that each trash receptacle in a neighborhood business district has a recycling container next to it. This way, anytime someone goes to throw something away, they at least have the option to recycle. Uniform signage that specifies exactly what can and can't be recycled is very important. Otherwise people are likely to use the recycling receptacle as another trash can. In addition, the City will work with businesses in the neighborhood to identify high traffic areas that might require

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[192] (Watch My Waste, 2017)
[193] (Wisconsin Department of Natural Resources, n.d.)

additional bins. The implementation of this program will help keep recyclables out of our landfills and show residents the importance of recycling whether you are at work, home, or out for a night of fun.

Examples in Cincinnati and Peer Cities
- Madison, WI
  - The City of Madison is working to ensure all public spaces have recycling receptacles.
  - https://www.cityofmadison.com/sustainability/documents/SustainPlan2011.pdf

Who will be taking the leading roles on this project?
- Office of Environment and Sustainability

Who is the target audience?
- Public places without recycling bins
- Places of high traffic in local business districts

What is the City of Cincinnati's role in implementation?

The City of Cincinnati will be responsible for hiring a third party to install recycling bins in local business districts

Is it feasible?
- Feasibility: Easy
  - Public recycling receptacles will require funding to install and funding for weekly collection. If funding can be secured, arranging for installation and servicing should not be difficult. The City already has public recycling receptacles in several of the City's public spaces.
- Obstacles:
  - Some container locations may be on private property and may require owner approval.

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio
$360,000 for installation plus $43,200 per year for weekly collection (To City of Cincinnati)	TBD (To waste collectors)	NA

Sidewalk recycling containers are already present in 4 neighborhood business districts.[194] An average sidewalk recycling receptacle costs $750 and we are looking to install 15 in each of 32 additional business districts. 480 containers would cost $360,000. Servicing the containers at $7.50 per container per month would cost $43,200 per year. This does not account for situations where a container needs to be serviced more than once per week.

Keys to Equity

- Preventing trash from overflowing and being blown into people's yards.

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[194] (Cincinnati Neighborhood Business Districts United, n.d.)

- Distribution of recycling receptacles throughout the City's business districts.
- Providing the same level of service in all neighborhoods.

Timeline for Implementation
- Expected: 1 - 2 years
  - Dependent on financing

Greenhouse Gas Impact

Annual Emissions Reduction Potential

2018	2023	2050
0 mtCO$_2$e	1,232 mtCO$_2$e	1,232 mtCO$_2$e

EPA estimates 2.87 mtCO$_2$e per ton of waste recycled instead of landfilled. In 2016, Cincinnati residents recycled 21,468 tons. We assume this recommendation would increase residential recycling by 2%, because it increases the number of containers by 2%.[195]

8. Implementation of a fee or ban to discourage use of single-use bags.

What is it and why is it important to Cincinnati?

When shopping to buy groceries, many Cincinnati residents take their things home in single-use bags – paper or plastic. While many grocery stores have a recycling program for plastic bags, many bags are not recycled. Plastic bags are an environmental threat to wildlife and ecosystems when these bags can dam up streams or be ingested by animals. A bag fee of $.05 to $.10 that shoppers pay for each bag would encourage people to bring their own reusable bags. As an alternative to the fee, the City could implement a complete ban on plastic and paper bags as some cities have begun doing around the country. This fee or ban could apply to any establishment using plastic or paper bags, or could be limited to stores larger than a specified size. This policy encourages shoppers to reduce the use of plastic and paper bags. and instead bring their own reusable bags.

The average plastic bag is used for only 12 minutes before being discarded, yet they will stay in our environment for hundreds of years. Paying a small fee would force shoppers to think twice about using a plastic bag. A portion of the money made from a fee will go to the City to be used to collect litter from our streets, parks and waterways. The money that doesn't go to the City will be retained by the retailer to cover the administrative costs of implementing and administering the program in their stores. Stores will be encouraged to use educational programming to help consumers transition to reusable bags.

Already grocery stores throughout the City offer reusable bag options. A ban would force residents to make the switch, but for residents who stop by the grocery store on the way home from work, it may be difficult for them to bring a reusable bag each time, especially if they rely on public transit. The implementation of this policy will give people an incentive to make the shift to reusable bags. The City will work with businesses to ensure they are offering alternatives to plastic and paper bags at their

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[195] (Watch My Waste, 2017)

establishments. The City will educate residents of the existence of the fee and the harmful effects of plastic bags on the environment to encourage them to make the behavioral shift away from single-use bags. This fee would reduce the reliance on single-use bags and work to keep them out of our local ecosystems. [196]

Examples in Cincinnati and Peer Cities
- Chicago, IL
  - In April of 2014, Chicago adopted a plastic bag ban for retailers of more than 10,000 square feet. The ban was extended to smaller chain stores and franchises in August 2016. Small independent or non-franchise stores and restaurants are not affected.

Who will be taking the leading roles on this project?
- ECO (Environmental Community Organization)
- Cincinnati Environmental Advisory Council
- Sierra Club

Who is the target audience?
- All retailers in Cincinnati

What is the City of Cincinnati's role in implementation?
- The City of Cincinnati will be responsible for adopting a single-use bag fee. The City will also lead a campaign informing residents of the existence of the bag fee and

Is it feasible?
- Feasibility: Easy
  - The Sierra Club has been a strong champion on this issue and will provide leadership for this recommendation.
- Obstacles:
  - The fee must be implemented in a way that is conscious of the concerns of retailers and grocery stores.
  - The fee must be implemented in a way that is sensitive the impact on low-income residents.

How much would it cost?

Cost	Benefit annual	Cost-Benefit Ratio
Nominal (To City of Cincinnati)	$485,000-$970,000 (To City of Cincinnati)	NA

Implementing a single-use bag fee comes at little to no cost to the City. Chicago has recently implemented a program at $0.07 per bag and reported that the tax has been successful at reducing consumption[197] and the fee has yielded revenues. Scaling the numbers by population in Cincinnati we can estimate the amount that will be collected. At a $0.05 fee we would expect $9,325 per week and at

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[196] (Center for Biological Diversity, 2017)
[197] (Svachula, 2017)

$0.10 we estimate $18,650 per week. Note, a successful plastic bag fee would reduce consumption and yield less revenue.

Keys to Equity

A plastic bag fee or ban would have impacts on equity in Cincinnati. For low income residents, even a small fee of 5 to 10 cents per bag can add up and become a financial burden. A ban would require residents to purchase reusable bags and bring them with them each time they go to the grocery store.

Impacts on low income residents can be addressed by reducing the fee per bag for shoppers using SNAP or able to show certain IDs. Reusable bags should be made available to low income shoppers at a reduced price. Some programs use money generated by a bag fee to purchase reusable bags for low-income residents. If a ban is implemented, a source of funding must be identified to help provide low income residents with reusable bags.

Timeline for Implementation
- 1 - 2 years
- With strong leadership behind this movement and the help of City Council, this recommendation could be implemented in a short time.

Greenhouse Gas Impact

Annual Emissions Reduction Potential

	2023	**2050**
Plastic bag fee	70.3 metric tons CO_2e	70.3 metric tons CO_2e
Plastic bag ban	104.9 metric tons CO_2e	104.9 metric tons CO_2e

To estimate the GHG savings of reducing the number of plastic bags used in Cincinnati, we assumed the average person uses 300 plastic bags per year, the CO_2 emissions inherent in producing a plastic bag are 1.17×10^{-3} kg CO_2e per bag (Muthu et al., 2011), and that 5-cent plastic bag fee would lead to a 67% decrease in plastic bag use. For a population of 298,800, this would lead to a savings of 70.3 metric tons of CO_2e per year for a plastic bag fee, or 104.9 CO_2e for a plastic bag ban. [198]

9. Improve recycling and waste reduction in City facilities.

What is it and why is it important to Cincinnati?

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[198] (Muthu, Li, & Mok, 2011)

Cincinnati city government generates a large amount of waste. While it has been improving in recent years with focuses on recycling and reducing waste, there is still room for improvement. Educating City employees on recycling practices can help to reduce waste in City facilities. The City can also convert more of its daily operations to electronic systems, reducing the amount of paper needed. Moving to e-signatures and electronic record keeping in all departments can make a significant difference.

The City of Cincinnati is encouraging residents to recycle and to reduce their waste. This is an opportunity to lead by example. Implementing sustainable practices in City facilities educates City employees and offers residents a chance to see City employees practicing sustainable habits in action when visiting a City building.

The City will re-evaluate its purchasing practice to ensure that they are ordering items that have the smallest environmental impact.

Examples in Cincinnati and Peer Cities
- Charlotte, NC
  - The City of Charlotte is working to ensure all City purchases are done with the goal of being as sustainable as possible.

Who will be taking the leading roles in implementation?
- Department of Public Works
- Office of Environment and Sustainability
- Division of Purchasing

Who is the target audience?
- All City facilities and departments

What is the City of Cincinnati's role in implementation?

The City of Cincinnati will be responsible for implementing green practices into City facilities and ensuring that they are reducing the amount of waste generated.

Is it feasible?
- Feasibility: Easy
  - The City of Cincinnati has already been working to implement more sustainable practices in City departments. This will be a continuation of these efforts with a special focus on reducing the amount of paper used in daily operations, helping to reduce costs for the City.
- Obstacles:
  - Switching to new technologies will require training of new systems for City employees.

How much will it cost?

Cost	Benefit	Cost-Benefit Ratio:
TBD (To City of Cincinnati)	TBD (To City of Cincinnati)	NA

Removing dependence on paper is likely to not require any expenditure or direct costs. This recommendation seeks to continue efforts such as the now paperless Civil Service meeting process and Water Works enrolling 30,000 additional customers to paperless billing systems.[199]

Keys to Equity

Reducing waste in City facilities will reduce waste going to the landfill. Sustainable purchasing will allow the City to help improve overall environmental conditions in the City. Additionally, for residents who visit City buildings, there may be an opportunity to engage with these sustainable practices and learn things they can take back to their own households.

Timeline for Implementation
- Expected: 1 - 2 years
    - The City will continue to encourage departments to operate in a more sustainable mindset. Identifying champions in each department will help to ensure that there is always a sustainable viewpoint in the room for decisions being made in each department.

Greenhouse Gas Impact

Annual Emissions Reduction Potential

2018	2023	2050
8.61 $mtCO_2e$	8.61 $mtCO_2e$	8.61 $mtCO_2e$

In 2017, 30 tons of recyclable material were collected. We assume improved efforts to recycle at City facilities could produce a 10% increase in annual recycling tonnage. EPA estimates 2.87 $mtCO_2e$ per ton of waste recycled instead of landfilled.

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[199] Further Reading: Greater Cincinnati Water Works Fiscal Years 2018-2019 All Funds Budget Volume I.

10.Conduct waste audit to understand the changing composition of our waste stream.

What it is and why is it important to Cincinnati?

To help reduce the amount of waste, we must first understand what Cincinnati residents are throwing in the garbage landfilling. A waste audit is an analysis of the waste being thrown away from a source, usually done by opening garbage bags and sorting the contents. Conducting a waste audit for Cincinnati will require the City to work with waste collectors to select trucks representing a cross section of the City.

Once the City knows how much of each type of material residents are throwing away, they can create programs that target specific materials, finding alternative uses for those waste streams other than sending them to the landfill. There are economic opportunities in repurposing, reusing, and recycling everyday waste. By conducting a waste audit, the City may be able to attract businesses that rely on a specific waste stream to produce their products, keeping it out of the landfill and supporting the local economy.

In addition to understanding what is in our waste, it would be helpful to understand where waste is being generated. Enhanced data collection along City trash pick-up routes could help in creating a targeted waste reduction education campaign based on the types of waste that residents are throwing away in their neighborhoods. Advancements in technology are making data collection possible and more affordable. The more the City knows about what types of waste are coming from where, the easier it will be to create waste reduction educational programming specific to Cincinnati.

Examples in Cincinnati and Peer Cities
- Cincinnati, OH
  - Hamilton County Solid Waste District conducted a waste audit in 2012.

Who will be taking the leading roles on this project?
- Hamilton County Solid Waste District
- Office of Environment and Sustainability
- Public Services

What is the City of Cincinnati's role in implementation?

The City of Cincinnati will work with the Hamilton County Solid Waste District to conduct a waste audit and analyze the results of a waste audit and develop strategies to implement a better waste management system.

Is it feasible?
- Feasibility: Easy

○ The Hamilton County Solid Waste District will be conducting a waste audit in 2018.

How much would it cost?

Cost	Benefit	Cost-Benefit Ratio
None-Marginal (To City of Cincinnati)	TBD (To City of Cincinnati)	NA

There will be minimal cost to the City. Hamilton County will be conducting a waste audit in 2018. The report will help inform future waste reduction efforts.

Keys to Equity

Understanding the City's waste stream will allow the City to improve its waste management system. Low income residents are often the ones who suffer the worst from an inadequate waste management system with litter ending up in their neighborhoods and trash accumulating in their nearby environment. A better waste management system will reduce the amount of trash ending up in the local Cincinnati environment reducing the impact on those neighborhoods where litter is most prevalent.

Timeline for Implementation
- Expected: 1 - 2 years
  - The Hamilton County Solid Waste District has a waste audit already planned for 2018.

Greenhouse Gas Impact

This recommendation will help inform strategies to reduce waste and increase recycling. It is not expected to have a direct impact on GHG emissions.

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