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Sustainable Akron: Akron's Zero Carbon, Zero Waste, 100% Renewable Energy Future

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Sustainable Akron:

Akron's Zero carbon, Zero waste, 100% Renewable Energy Future

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Abstract

This report attempts to show that it is not just possible for the City of Akron to transition to a more sustainable city, but that it may be socially and economically beneficial for the city to do so. This report builds on Greenprint for Akron, the City of Akron's Climate Action Plan, and serves to complement city development plans as well as guide the adoption of future climate related policies. This report provides a limited but updated climate and sustainability assessment of the City of Akron and employs a framework of three fundamental aspects of a sustainable and resilient city: zero carbon, zero waste, and 100% renewable energy generation. Using the climate action plans from six cities from the Midwest and Northeast, this report synthesizes a list of policy recommendations that are applicable to the City of Akron, actionable, and support the three fundamental goals of sustainability. The purpose of this report is to revive interest in sustainability and climate action within the city government and to center sustainability as an essential consideration for the future of the City of Akron.

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Introduction

Despite the resounding consensus surrounding anthropogenic climate disruption, accumulated over the last several decades, little action has been taken to curb the human impact on Earth's climate at a national or global scale. With little over a decade left in which to mitigate the most serious consequences of climate disruption by limiting global warming to two degrees celsius, evidence suggests that it is entirely unlikely that current national and global trends will be altered sufficiently to avoid climate catastrophe, if current approaches to climate policy should remain relatively unchanged (Allen et al., 2018; Bendell, 2018; Climate Action Tracker, 2019; Collins, Fankhauser & Gennaioli, 2015; Fifita et al., 2018). As a result of this reality, the leaders of cities, towns, villages and municipalities across the world have, in the last decade, committed themselves to taking responsibility for their actions, changing their behaviors, and cultivating a new relationship with the environment they live in and the resources they consume (Alliance for a Sustainable Future, 2018). In the United States, local, county, and state governments have taken steps to address issues of sustainability and resilience within their communities while the federal government has remained relatively inactive (America's Pledge, 2017; ReadyFor100, 2019a).

This global movement is not only rooted in moral and ethical concerns for people and planet, it is directly tied to issues of community development, equity, and prosperity (Alliance for a Sustainable Future, 2018; America's Pledge, 2017). Sustainable policies and actions have become a useful tool for cities, large and small, to pursue a plethora of goals that simultaneously deliver social and economic benefits (Calhoun et al., 2017). The moral and ethical arguments for

reducing carbon emissions, reducing waste, transitioning to renewable energy sources, and so on are matched by viable socioeconomic arguments. Sustainable and resilient projects offer benefits that are not only desirable to the City of Akron, but have the potential to solve many of the problems that Akron faces.

Thus, the purpose of this report is to encourage the City of Akron to become more sustainable, resilient, and equitable by pursuing the goals of 100% renewable energy, zero carbon, and zero waste. A decade ago, with the creation of Greenprint for Akron, the City of Akron took steps towards addressing its relationship with the environment (Feezel et al., 2009). Yet, much progressive remains to be made and few analyses of Akron's socioeconomic predicaments consider the potential. In this way, this report serves as a continuation of Akron's Greenprint Climate Action Plan, acting as a guide for future sustainable legislation, initiatives, and development.

This report is not intended as a comprehensive, overarching climate action plan. Rather, it is meant to provide clear, constructive, and recognized policy and action recommendations that should work in tandem with Greenprint for Akron and other city plans, such as Urban Renewal Plans, DriveAkron, Planning to Grow Akron, and so on. This report strives to encapsulate the major dimensions of a sustainable, resilient, and equitable community, but it is not an exhaustive study of the many possible programs, policies, and actions that could fit into or complement such a framework. Thus, as the research included in this paper is limited in scope, the recommendations to follow will acknowledge those places where additional research or exploration should be carried out and is likely to be fruitful.

Sustainable Framework

Though specific emissions targets and other sustainable goals will inevitably be dependent upon the capacity of the City of Akron, it is necessary to set goals which are bold and which push the envelope of practicality. Evidence suggests that adopting strong “flagship laws” regarding climate action is associated with further and sustained climate action (Collins, Fankhauser & Gennaioli, 2015). Addressing climate change and issues of environmental sustainability are, now more than ever, about more than morals and ethics. Economic and social benefits are nearly guaranteed to follow the adoption and pursuit of sustainable policies (Calhoun et al., 2017).

The Intergovernmental Panel on Climate Change (IPCC) and the United Nations (UN), along with organizations such as the Sierra Club, 350.org, the Youth Climate Strike, and the Climate Action Network recommend drastically reducing greenhouse gas (GHG) emissions, among other targets, by 2050, though it is resolutely preferred that significant reductions happen sooner rather than later (Fifita et al., 2018; UN-Habitat, 2015). Specifically, the latest report published by the IPCC recommends reducing annual GHG emissions by between 40% and 60% by 2030, with net-zero to zero GHG emissions achieved by 2050 (Fifita et al., 2018). These reduction targets use the total GHG emissions measured for 2010 as the baseline benchmark for plotting emissions reduction scenarios and targets (Fifita et al., 2018). The City of Akron, in its 2007-2009 Greenprint for Akron report, used communitywide GHG emissions for 2005 as a benchmark for measuring GHG emission reductions and improved sustainability (Carmen et al., 2012; Feezel et al., 2009). The City of Akron, in 2012, measured GHG emissions for 2009 and updated Greenprint for Akron with these new measures as well as with revised 2005 GHG

emissions measures (Carmen, 2012). For the purposes of this paper, Akron's GHG emissions for 2005 will act as the baseline for plotting emission reduction targets that are in accordance with the IPCC's recommendations and the practices of chosen model cities.

This paper argues that the City of Akron, to become a socially and economically sustainable, resilient city, must commit itself to the three goals of zero carbon emissions, zero waste production, and one hundred percent renewable energy communitywide. These goals will act as a sustainability framework to guide climate policy and action. Specific targets within this framework, detailed in later sections of this report, include 100% renewable energy by 2040, a 90% reduction in waste generation by 2040, and carbon neutrality by 2050. These are communitywide targets that include local government operations, however, a separate target of 100% renewable energy by 2030 for all local government operations will also be recommended.

Working Definitions

Understanding these goals and using them as meaningful guides requires specific and measurable definitions. This paper uses "zero-carbon" to mean the elimination of all GHG emissions from all sources communitywide. As all sources of GHG emissions, including deforestation, the use of biogas and biomass, combustion processes, carbon intensive agriculture, and so on, must be eliminated to achieve zero carbon, the term is loosely defined as at least a 90% reduction in GHG emissions coupled with negative carbon sequestration or carbon offsetting schemes (Climate Action Network International, 2014). Relying solely on carbon offsets to achieve zero GHG emissions is not entirely preferable as the socioeconomic benefits accrued from a real reduction in local emissions are less likely to be had. Therefore

“zero-carbon” will refer to those recommendations that contribute to a direct or real reduction in communitywide GHG emissions.

In this respect, “net zero” carbon emissions is distinct from “zero carbon” in that it describes the balancing of GHG emissions with carbon sequestration and carbon offsetting schemes. Specific carbon sequestration schemes will be discussed below in relation to the City of Akron’s urban tree canopy. This report recommends carbon offsets only as a final recourse to achieving net zero carbon by 2040. That is, in terms of the zero carbon goal, carbon offsets should only be utilized as a means of offsetting the last communitywide GHG emissions after all other GHG emission reduction strategies have been exhausted..

Though no definitive definition exists for “zero-waste,” this report understands the term as the complete elimination or diversion from landfills, dumps, oceans, and other areas of all municipal solid waste materials and products generated by the City of Akron (U.S. Environmental Protection Agency [EPA], 2019b). Municipal solid waste is defined by the U.S. EPA as waste generated by residential, commercial, institutional, and light industrial processes, while diversion includes the reusing and recycling of waste products and materials (2017). Waste incineration and use in biofuels is not considered by this report to be a form of waste elimination nor diversion and will not be recommended as viable options for achieving a 90% reduction in waste generation by 2040 (Lehmann, 2010) . Although recycling waste products is and will be an essential means of reducing communitywide waste, this paper will emphasize the roles of reduction and reuse, among other actions, for achieving the 90% reduction in waste generation target.

The goal of “100% renewable energy” communitywide is used to mean the complete electrification of the City of Akron’s energy usage and the complete transitioning of communitywide energy generation to renewable energy sources (ReadyFor100, 2019b). Though renewable energy credits (RECs) offer an accessible alternative to achieving 100% renewable energy generation locally, this paper considers them to be only marginally beneficial to local communities and recommends that they be utilized only as a final recourse to achieving 100% renewable energy communitywide. 100% renewable energy generation for local government operations is taken to mean the complete electrification of all city government operations and the complete transitioning of all city government energy generation to renewable energy sources. As an additional caveat, this report does not consider nuclear energy generation to be a clean, renewable energy source and will not recommend its use in achieving 100% renewable energy communitywide. Evidence suggests that nuclear energy generation is more expensive than solar and wind renewable energy sources and does not lead to significant GHG emission reductions (Jin & Kim, 2018; Cebulla & Jacobson, 2018).

Akron's Climate Assessment

Realistic and compelling climate action plans require well defined goals and benchmarks, which in turn require reliable and accurate information regarding energy use, GHG emissions, and waste generation (Collins, Fankhauser & Gennaioli, 2015; ReadyFor100, 2019b; U.S. EPA, 2016a). This section will detail the effects of climate disruption already experienced in the City of Akron, the city's carbon footprint, and its environmental assets. These include data for the City of Akron's average annual temperature and precipitation trends, energy usage, GHG emissions, waste trends, and tree canopy coverage. Fortunately, the City of Akron has taken steps in the past to analyze and quantify some of these data sets. The 2009-2012 Greenprint for Akron report detailed municipal government and communitywide GHG emissions, the 2013 Urban Canopy Assessment analyzed vegetation coverage, and Summit ReWorks', formerly Akron Solid Waste Authority, summary reports detailed recycle and waste tonnage for all Summit County municipalities from 2012 to 2016 (Feezel et al., 2009; Carmen et al., 2012; Summit ReWorks, 2012; Summit ReWorks, 2013; Summit ReWorks, 2015; Summit ReWorks, 2016; Plant-It GEO, 2013). Additional data regarding annual average temperature and precipitation totals was gathered from the National Oceanic and Atmospheric Administration and energy use and GHG emissions data was gathered from the U.S. Department of Energy.

Climate Disruption in Akron

Climate data for the City of Akron and the Ohio Valley suggest that climate disruption is already having measurable effects on the region. Over the past several decades, since 1950, annual average temperatures have risen by nearly two degrees fahrenheit (Figure 1), annual precipitation totals have increased by nearly ten inches (Figure 2), and extreme climate and

precipitation events have become more frequent (Figure 3)(Figure 4). Much like Cleveland, the City of Akron will experience warmer, wetter weather and more numerous extreme weather events including deluge rainfalls over the next several decades and beyond (Sustainable Cleveland, 2018). These changes in regional climate have the potential to affect public health, agriculture, and infrastructure, among other things, necessitating actions and policies which increase the City of Akron's sustainability, resilience, and resource security (EPA, 2016b).

Energy Use and GHG Emissions

The City of Akron completed two energy and GHG emissions assessments between 2009-2012 (Carmen et al., 2012; Feezel et al., 2009). Greenprint for Akron used energy consumption data from 2005 and 2009 to estimate the equivalent carbon dioxide (CO₂e) emissions generated by the City of Akron (Carmen et al., 2012; Feezel et al., 2009). These offered communitywide and local government GHG emission measures for the City of Akron. The 2005 GHG emission totals (Figure 5) became the baseline for measuring the City of Akron's progress on GHG emission reductions. Community GHG emission totals were calculated for residential, commercial, industrial, transportation, and waste sectors (Feezel et al., 2009). Government GHG emissions were calculated for municipal buildings and facilities, streetlights, traffic signals, parking lights, water delivery facilities, wastewater treatment facilities, airport facilities, solid waste facilities, steam facilities, vehicle fleet, mobile equipment, and employee commutes (Feezel et al., 2009).

In calculating the total GHG emissions for the City of Akron and its related sectors, Greenprint for Akron employed an emissions scopes framework to better account for and

categorize direct and indirect GHG emissions. These scopes, taken from the International Council for Local Environmental Initiatives, were defined as follows:

Scope 1: Direct GHG emissions (with the exception of direct CO₂ emissions from biogenic sources) from sources located within the geopolitical boundary of the local government.

Scope 2: Indirect emissions associated with the consumption of purchased or acquired electricity, steam, heating, and cooling. Scope 2 emissions occur as a result of activities that take place within the geopolitical boundary of the local government, but that occur at sources located outside of the government's jurisdiction.

Scope 3: All other indirect or embodied emissions not covered in Scope 2 that occurs as a result of activity within the geopolitical boundary. (Carmen et al., 2012; Feezel et al., 2009)

Greenprint for Akron also employed a separate, though only marginally modified, scopes emissions framework for local government operations (Carmen et al., 2012; Feezel et al., 2009). Although Greenprint for Akron states that Scopes 1 and 2 are the most essential frames as they capture the most significant sources of GHG emissions within a community, it is worth noting that consumption-based GHG emissions are typically underestimated in sector-based or production-based GHG emission analyses which Greenprint for Akron relies upon (Barrett et al., 2018; Carmen et al., 2012). This is evident by the lack of data detailing the City of Akron's communitywide Scope 3 GHG emissions (Carmen et al., 2012). A consumption-based analysis could have been incorporated into the original Greenprint for Akron report through a Scope 3 analysis. We can assume that these indirect consumption-based GHG emissions contribute to a

larger carbon footprint for the City of Akron than was measured, however, efforts to quantify specifically consumption-based GHG emissions are beyond the scope of this report.

Data from the U.S. Department of Energy pertaining to state and local energy measures was utilized in order to approximate energy consumption (Figure 6) and carbon equivalent emissions for the City of Akron. This data was limited, thus only partial estimates and projections could be made. The City of Akron does appear to have met the Greenprint for Akron 10% GHG emission reduction target for 2018 (Figure 7), however, following roughly the same trajectory would mean the City would miss the 20% GHG emission reduction target for 2025 (Figure 7). It should also be noted that energy consumption and related GHG emission reductions in the City of Akron have not substantially deviated from similar trends at the state and national level (Figure 8), meaning that local climate action over the last decade may not have had a substantial impact on GHG emission reductions. Further, Ohio's transition from coal to natural gas over the last decade is responsible for the state's GHG emission reductions, supporting the assumption that measured GHG emission reductions for the City of Akron are products of natural gas proliferation rather than climate action (Kowalski, 2018).

Urban Tree Canopy and Green Space

The City of Akron conducted an Urban Tree Canopy (UTC) Assessment in 2013. The assessment grouped land coverage into four categories: areas with an existing tree canopy, vegetated and impervious areas where planting was possible, and areas where planting trees was not feasible (Plan-It GEO, 2013). These categories were used to give land coverage measures for the City of Akron as a whole, as well as coverage information for each ward, zoning district, watershed, neighborhood, census block, and parcel. The assessment also identified specific tree

planting sites within the possible tree planting areas. This assessment and its recommendations were then incorporated into the City of Akron's Master Tree Planting Plan under the direction of the city Arborist (City of Akron, 2016).

The Urban Tree Canopy Assessment calculated the City of Akron's total urban tree canopy to be 37% of Akron's total land area (Plant-It GEO, 2013). The study suggested Akron work to achieve an urban tree canopy coverage of 40%, which the City of Akron adopted as its target tree canopy coverage rate (City of Akron, 2016). However, American Forests, the organization which developed the 40% goal, no longer recommends 40% UTC as a blanket goal for all geographical areas (Leahy, 2017). American Forests instead recommends 40-60% urban tree canopy coverage for cities in forested states that have the necessary conditions for supporting more extensive urban forests (Leahy, 2017).

Though current information regarding Akron's UTC is unavailable and no updates have been issued regarding Akron's progress towards the 40% UTC goal, the City of Akron certainly has the potential to expand its urban forest beyond the 40% recommendation.

Municipal Solid Waste and Composting

Summit ReWorks conducts periodic assessments of solid waste collection and waste diversion for all municipalities within Summit county. Municipal solid waste data was collected for 2012, 2013, 2015, and 2016 (Figure 9). In each year the City of Akron had a rate of solid waste diversion (recycling both including and excluding yard waste) slightly less than the diversion rate for Summit county overall. Additionally, Summit county's overall recycling and composting rates continuously increased as Akron's recycling and composting rates remained relatively stagnant (Summit ReWorks, 2012; Summit ReWorks, 2013; Summit ReWorks, 2015;

Summit ReWorks, 2016). The city's total waste disposal decreased at a faster rate than did Summit county's over the four years for which data could be obtained (Summit ReWorks, 2012; Summit ReWorks, 2013; Summit ReWorks, 2015; Summit ReWorks, 2016).

ReWorks' vision statement does include "zero waste" as the organization's defining goal, and its integrated plan specifies specific waste reduction strategies and projections for all residential, commercial, and industrial wastes (Summit/Akron Solid Waste Management Authority, 2014). These projections, if accurate, are far from achieving zero waste throughout Summit County, regardless of whether commercial and industrial waste projections are included (Figure 10). The City of Akron's waste disposal rate, according to the four years of reported residential waste data, is projected to decrease more by 2050 than Summit County's waste disposal rate, although data regarding Akron's recycling and composting trends do not necessarily reflect this.

Solar Installation Potential

Reducing carbon emissions depends upon the utilization of renewable energy technologies, and effectively deploying those technologies requires survey data detailing the possible placement sites suitable for such installations and the energy generating potential of those locations. As Ohio's rollback of renewable energy standards has effectively eliminated the feasibility of wind energy generation, this report will only deal with the energy generating potential of solar energy (Siegel, 2019). In 2018, Google launched Project Sunroof, a solar installation calculator that uses energy generating potential data from the U.S. Department of Energy's State and Local Energy Data resource. Though such calculators are typically less accurate than field analysis, Project Sunroof's methodology provides useful estimates for

communitywide rooftop solar installations. For this reason, Google's Project Sunroof will be used to detail the City of Akron's rooftop solar potential. Figure 11 shows the total area of roofs with solar installation potential while Figure 12 shows the relative energy generating potential of each of those roof types and sizes.

Part 2: Comparative Analysis

Methodology

This report utilizes the Climate Action Plans (CAPs), findings, and strategies of a number of cities in the Midwest and Northeast United States in order to synthesize a comprehensive set of climate action and policy recommendations. The sampled cities include Cincinnati, Ohio; Cleveland, Ohio; Lowell, Massachusetts; Minneapolis, Minnesota; St. Louis, Missouri; and Washington, DC. These cities were selected, in part, based upon a set of fundamental characteristics that they share with the City of Akron. These characteristics, together, are descriptive of “legacy cities,” a term defined by the Lincoln Institute of Land Policy and the Greater Ohio Policy Center as fitting the following characterization:

- Legacy cities are generally located “in the Midwest and Northeast—the [] Rust Belt of the United States;”
- have populations of between 30,000 and 1.5 million residents (though the sampled legacy cities in this report have populations of between 100,000 and 800,000 residents), but have experienced significant population decline since the second half of the 20th century;
- have histories of “manufacturing [as] the core of the employment base and economic output,” but have experienced significant job loss since the second half of the 20th century;
- have experienced “growth in poverty rates and disinvestment in downtowns and urban neighborhoods;”

- “have a clearly urban downtown core surrounded by a mix of residential neighborhoods, some stable and some afflicted by disinvestment, as well as extensive suburban and exurban development beyond the city’s boundaries;”
 - have experienced a "reduced housing market demand that [has] led to diminished property values and abandonment;”
 - and have experienced little to no economic recovery since the Great Recession.
- (Brachman & Mallach, 2013; DiSalvo Development Advisors & Hollingsworth; Hollingsworth & Goebel, 2017; Legacy City Design Initiative, 2019)

The list of legacy cities with these characteristics was cross referenced with the Sierra Club’s Ready For 100 campaign’s list of cities that have developed CAPs and are formally committed to reaching, among other targets, 100% renewable energy generation by 2050 (ReadyFor100, 2019a). This comparison resulted in the six cities listed above that have adopted formal CAPs and share similar fundamental legacy city characteristics with the City of Akron.

Next, each action and policy recommendation contained within the CAPs of these six cities were analyzed according to their applicability to the City of Akron; their actionability, that is, their practicality and the likelihood that the City of Akron could take the action or implement the policy given certain structural constraints (e.g. budget constraints, legal constraints, the lack of direct management of utility companies, etc.); and the probability that the action or policy would contribute directly or indirectly to the achievement of the three fundamental goals of sustainability (i.e. zero carbon, zero waste, and 100% renewable energy).

Finally, the resulting list of recommendations were cross-referenced against Greenprint for Akron’s action and policy recommendations to remove redundant recommendations. This

yielded a final synthesized list of policies that were specifically tailored to the City of Akron. These policies are detailed and expanded upon in later sections of this report. Some redundant recommendations and recommendations not explicitly included in the analyzed CAPs that are deemed integral, foundational, or essential to the City of Akron's transition to a sustainable city are included also.

Measuring the Social and Economic Benefits of Sustainability

As these model cities share fundamental characteristics with the City of Akron, correlations between the sustainable policies and actions of these cities and measures of social and economic benefits would mean that the City of Akron could expect similar beneficial results from the implementation of similar climate action policies. To measure social and economic benefits in these cities, a number of indicators were selected that could be quantified with accessible data. Together, these indicators attempt to measure the relative socioeconomic benefits experienced by a city that are correlated with the climate actions and policies of that municipality. The City of Akron will be used as the control variable for most of these measures as the city is similar in fundamental ways to the model cities and does not currently have an active CAP nor related government body. This measurement scheme included the following indicators:

- Air quality (Figure 13);
- Rates of family poverty (Figure 14);
- Median household income (Figure 15);
- Weighted crime rates (Figure 16);
- Measures of food security (Figures 17-21);

- Measures of economic and racial inclusion (Figures 22-24)
- And measures of economic health and job growth within selected sectors (25-30).

The model cities passed their respective CAPs between 2008 and 2013, with updated plans or resolutions supporting more aggressive actions, such as 100% renewable energy communitywide, passed between 2015 and 2019. Akron also adopted its Greenprint in 2009 and revised the plan in 2012. Data will be analyzed with respect to these dates by acknowledging trends prior to the adoption of CAPs and identifying trend changes, if any, that could be ascribed to the adoption of those plans. Importantly, trends that are similar for all model cities and trends that diverge from the City of Akron will be identified as having possible causal relations with the implementation of climate action policies.

Data Analysis

The first measure of the socioeconomic benefits of sustainability is air quality (Figure 13). The transition to renewable energy generation, the greening of urban environments, and the limiting and eliminating of traffic all directly impact the air quality within a region (World Health Organization, 2019). Air quality also directly affects the incidence of diseases, such as asthma, and other medical conditions (World Health Organization, 2019). These have real costs associated with them, so any improvement in air quality should result in healthier lives and lower medical costs. Figure 13 compiles Air Quality Index data points for the six model cities and Akron between 2000 and 2018. Since 2000 the City of Akron has experienced a significant improvement in its air quality, similar to the trends of the model cities (Ait Data, 2018). There is a clear correlation between the air quality trends of all of the cities, however, there is no significant difference between the trends of the model cities and the trend of the City of Akron.

The measure of the percentage of families below the poverty line (Figure 14) and median household income (Figure 15) indicate similar trends between the cities. For all cities except Lowell, MA, the percentage of families below the poverty line has decreased modestly since 2014 and 2015. All cities except Lowell, MA, and Cleveland, OH, have experienced modest upswings in median household income levels, especially Washington, DC, and St. Louis. While both cities have experienced better economic recoveries than traditionally “rust-belt” cities, the substantial increases in median household income could be significantly related to social and economic sustainability policies. It should be noted though, that these trends haven’t changed since the more recent adoption of updated plans.

The City-Data crime index (Figure 16) weights violent crime and property crime to accurately measure the intensity of crime rates within each city (City-Data, 2019). Though all cities except Cleveland, OH have tended to experienced crime rates that have declined with the national average since 2008 and 2010, Lowell, Cincinnati, St. Louis, Washington, DC, and Minneapolis have all experienced rates of decline greater than the national average while Akron’s crime rate has declined only slightly.

Food security and insecurity were measured by county and by the relative presence of accessible sources of food. As all of the CAPs supported increasing local farming and increasing the accessibility of healthful, local foods, measures of farmers markets provide accurate indicators of progress towards improved food security. All cities, including Akron and excluding Cincinnati and Cleveland, experienced either stagnant or improving rates of access to grocery stores for populations overall and low income populations (Figure 17 & 18), though the number of grocery stores per every 1000 residents remained stagnant between 2009 and 2014 (Figure

19). All cities, especially Washington, DC, experienced significant increases in the number of farmers markets per every 1000 residents (Figure 20), supporting the assumption that climate action policies relating to local food production may have a measurable effect. Food insecurity rates across each of the model cities' counties fell modestly between 2015 and 2017, mirroring the national average trend (Figure 21). It is worth noting, however, that these measures could only be obtained for years prior to 2016 and 2017, so any trends produced by more recent policies or actions cannot be identified.

Racial and economic measures of inclusion were compiled from the Urban Institute. These employed indicators of income and racial segregation, poverty, educational attainment, and housing ownership and affordability (Urban Institute, 2018). Overall inclusion in Lowell, Washington, DC, Cleveland, and Cincinnati improved between 2000 and 2013, while inclusion worsened in St. Louis, Akron, and Minneapolis (Figure 22). Racial inclusion (Figure 23) improved in only Lowell and Washington, DC, between the same time period while economic inclusion (Figure 24) improved for all cities except Akron, St. Luis, and Washington, DC. Economic health (Figure 25) measured job growth, vacancy, and employment rates, and significantly improved in only Washington, DC, between 2000 and 2013. While these measures, again, do not provide recent information for the cities, the City of Lowell's significant improvement in racial and economic inclusion in 2013 could be a product of its actions on sustainability beginning in 2009. Similarly, though Washington, DC's economic improvements are largely driven by substantial increases in population over the period between 2000 and 2013, its economic health could relate to the early and aggressive climate actions taken by the city.

The last set of economic indicators measured job growth within selected sectors and the annual number of solar jobs in counties between 2015 and 2018. While the counties containing every model city had more solar jobs per year than Summit county, Middlesex and Hennepin counties, containing Lowell, MA, and Minneapolis, MN, respectively, had far higher levels of solar related jobs from 2015 to 2018 (Figure 26). These can be confidently ascribed, in part, to the climate action policies of Lowell and Minneapolis, though surrounding municipal, county, and state policies are also directly related to solar job increases. Data from the Bureau of Labor Statistics (BLS) was gathered for specific industries that have the highest number of green jobs and produce the highest number of green goods. Though the Bureau of Labor Statistics stopped recording specific green job and product statistics in 2013, statistics for supersectors in which those industries are situated are still recorded (U.S. Bureau of Labor Statistics, 2013). The annual percent change of employment within the mining, logging, and construction industries; the transport and utility industries; the administrative and support and waste management and remediation services industries; the manufacturing industry; and local government were compiled and analyzed (Figures 27-31). Though there were no significant trends or differences between the cities, the City of Akron experienced lower annual percent changes and the most negative annual percent changes in employment in each sector, especially after 2014 and 2015, while Cleveland and Cincinnati experienced positive increases in employment changes in most sectors after 2015. Most cities also generally had positive percent changes in employment after the 2008 recession and the subsequent recovery period when most initial CAPs were passed.

Quality of Indicators and Measured Data

Measuring the social and economic benefits of sustainability is an imperfect science at best. Though some of the data indicate slight correlations between the general implementation of climate action policies (i.e. the adoption of CAPs) and socioeconomic benefits, none can be considered significant as there are too many variables left unmeasured and the trends are too disparate to be confidently ascribed to any one cause. Whether the trends observed are a result of implemented climate policy, certain fundamental variables, or any other logical causal process is difficult to determine. Most indicators for the benefits of sustainability require rigorous recording and reporting by municipalities, which most cities do not expend the resources to do.

Further, it may be too soon to measure any discernible effects of the climate actions of these cities. Most CAPs studied have been in place for no more than a few year and have policy and action targets ranging from 2030 to 2050. It is reasonable to assume that any policy already implemented may be too insignificant and the time period too short for any statistical significance between that policy and social and economic benefits to be measured. That is not to say that real benefits are not tangible in the short term; for instance, cities that invested in energy efficient retrofits for municipal buildings, LED replacements in buildings and street lights, and solar or other on-site renewable energy generation technologies have seen savings in utility costs immediately (Department of Planning and Development, 2019; Minneapolis Sustainability, 2017). These savings are generally marginal compared to total city expenditures and require significant up front costs in some cases, but they provide good indices of the potential energy use reducing and cost reducing benefits of increased sustainability. This report does not consider these to be socioeconomic benefits as they do not affect a significant segment of a city's

population. Utility savings could be considered a socioeconomic benefit for residents, however, specific rate and savings information are not available for most of the cities studied, and none have progressed far enough towards their climate action goals to produce the utility savings that renewable energy can provide.

Part 3: Recommendations for the City of Akron

Though no specific correlations between short term social and economic benefits and climate action policies could be readily discerned, climate action does still provide long term benefits. The climate action policies studied do provide useful projections to that effect. This section of the report will layout the recommendations, compiled from the six model CAPs, that are most applicable to the City of Akron, actionable, and have the greatest probability of enabling the city to achieve the primary goals of zero carbon, zero waste, and 100% renewable energy. As Greenprint for Akron has already laid out recommendations for increasing sustainability within the City of Akron, these recommendations are designed to build upon the initial CAP in meaningful and constructive ways. As most policies and actions will provide cross-cutting benefits, the recommendations to follow will not be in order of priority, though it is recommended that foundational policies be explored first. Where multiple policy or action recommendations are grouped under one broad subject, subheadings will delineate specific recommendations.

Revive Akron's Green Ribbon Panel

Pursuing sustainable goals is best realized through an official working group, task force, commission, or department that is dedicated to sustainability. Reviving Akron's Green Ribbon Panel or instituting a similar body is a vital step in ensuring the city sets, maintains, and achieves sustainable and resilient goals. This action could be taken immediately and would require little effort to implement, notwithstanding coordination conflicts between department representatives. Though the goals of sustainability and of Greenprint for Akron still guide, to an extent, the decisions, actions, and strategies of city departments, it is unlikely that further goals will be

developed or pursued without an active body that is dedicated to matters of sustainability (Keep Akron Beautiful, 2019). Especially as the City of Akron pursues aggressive urban redevelopment projects, it is imperative that sustainability becomes a central issue. This is best achieved through a formal body with the time, resources, and leverage to ensure that sustainability is incorporated into current and future development plans, and that climate action is prioritized and balanced with economic and other concerns.

Except for the City of St. Louis, MO, every model city has established a permanent department, office, commission, or council with adequate budgeted resources and powers to effectively pursue sustainable goals and implement their respective CAPs. Municipalities budgeted between \$140,000 and \$18,000,000 for these government bodies, though in the case of Lowell, MA and Washington, DC, budgets were provided for government departments of which their sustainability office or commission was a part of (City of Cincinnati, OH, 2019; City of Cleveland, OH, 2019; Lowell, MA, 2019; City of Minneapolis, MN, 2019; City of St. Louis, MO, 2019; City of Washington, DC, 2019). These formal bodies enable streamlined communication and cooperation between departments, and while their budgets aren't necessarily indicative of their effectiveness in achieving sustainable goals, the cities with the most well funded sustainability offices and departments (Minneapolis, MN, Cleveland, OH, and Washington, DC) also have some of the most robust CAPs.

Considering the City of Akron's current budget constraints, described in the Blue Ribbon Task Force's 2016 report, creating a mayoral initiative or reinstating Akron's Green Ribbon Panel would prove to be the least expensive options while ensuring an approach to sustainability that could more effectively advance climate policy (Akron Blue Ribbon Task Force, 2016).

Though the panel was previously only temporary, it is highly recommended that a revived Green Ribbon Panel be a permanent government fixture in the City of Akron and be charged with further developing and implementing policy recommendations.

Revive and Revise Greenprint for Akron, Akron Climate Action Plan

Similarly, reviving Greenprint for Akron, reaffirming the goals and principles it laid out, as well as updating the document according to the recommendations presented in this report will provide a framework for critically analysing and addressing the sustainable nature of the City of Akron, its projects, actions, and practices. Research indicates that effective climate legislation is correlated with strong climate policy frameworks that are able to guide continued climate action (Collins, Fankhauser & Gennaioli, 2015). Reviving Akron's CAP would also acknowledge that Akron is truly committed to the project of sustainability, especially considering cities are surpassing national governments as "key implementers of" climate disruption solutions (Bazaz et al., 2018).

The updated Greenprint for Akron CAP should include a progress report with respect to past and current GHG emissions, energy use reductions, as well as planned projects, programs, and initiatives laid out in the original document. The updated CAP should also incorporate additional goals, recommendations, and targets that reflect changes in information, technology, and best practices since 2012, when Greenprint for Akron was last updated.

Set Specific Targets

Perhaps one of Greenprint for Akron's most significant shortcomings, relative to the model CAPs studied, was its limited use of specific targets and timeframes. Where targets were used, namely with respect to decreasing GHG emissions by 5%, 10%, and 20% by 2013, 2018,

and 2025 respectively, they were less ambitious and limited to a narrow timeframe (Carmen et al., 2012; Feezel et al., 2009). The model CAPs embody long term commitments to ambitious goals that are meant to significantly reduce or eliminate the environmental footprints of their respective cities. Similarly, the City of Akron should attach to any climate policies specific targets that reflect a high carbon-footprint-reducing potential within an ambitious timeframe. The following policy recommendations represent specific climate action targets derived from the three goals of the sustainable framework.

Carbon neutrality by 2050.

This report recommends that the City of Akron pass a resolution that commits the city to a goal of reaching net-zero carbon emissions (i.e. carbon neutrality) by 2050, with provisions that commit the city to achieving zero-carbon emissions soon after. The IPCC's SR15 report estimates that net carbon emissions must decline by 40-60% by 2030, with net zero carbon achieved by 2050, in order to limit global warming to a manageable threshold (Fifita et al., 2018). This report uses these reduction targets as the "safe zone" for GHG emission reduction scenarios. Figure 7 models the GHG emission trajectories for four different emission reduction scenarios: (a) business as usual trendline, where GHG emission trends remain the same; (b) Greenprint for Akron's GHG emission reduction trendline corresponding to the plan's original targets; (c) the IPCC's minimum recommendation of a 40% reduction in GHG emissions by 2030 trendline; and (d) the IPCC's maximum recommendation of a 60% reduction in GHG emissions by 2030 trendline (Carmen et al., 2012; Fifita et al., 2018). (Typically, GHG emission reduction scenarios are not linear, however, for the purposes of small scale city emission reductions, linear trendlines will suffice.)

Neither the business as usual scenario nor Greenprint for Akron's GHG emission reduction recommendations substantially reduce the City of Akron's communitywide emissions to "safe zone" GHG emission forecasts by 2050. If the city is to substantially reduce its carbon footprint in a meaningful timeframe, as the mayor has indicated the city intends to do, then a GHG emission reduction target that meets the IPCC and this report's recommendations must be formally adopted (Horrigan, 2017).

As the goal of zero carbon requires the complete elimination of carbon emissions, there is no specific time frame attached to the zero carbon target. Most policy recommendations detailed in this report are aimed at reducing the City of Akron's carbon footprint or putting in place the ordinances and guidelines which will allow the city to effectively reduce its carbon footprint. However, it is beyond the scope of this report to formulate a specific zero carbon scenario. Rather, this recommendation serves as a long term goal of climate action. An exploration into the feasibility of transitioning Akron to a carbon-free city may be worthwhile and beneficial, however, this report does not recommend such a study within the immediate time frame as resources are better utilized pursuing other targets.

100% renewable energy communitywide by 2040.

It is recommended that the Akron City Council and the Mayor follow other cities by jointly adopting a resolution that commits the City of Akron to a goal of reaching 100% renewable energy communitywide by 2040. This report provides only a partial analysis of the feasibility of a communitywide 100% renewable energy goal. Thus the City of Akron should conduct a more thorough and comprehensive analysis detailing the exact path available to the city for achieving this goal.

All of the cities studied have made formal commitments, in the form of resolutions or climate action legislation, to achieve significant levels of renewable energy generation by midcentury. Cincinnati, OH and Minneapolis, MN, have committed themselves to producing 80% of all energy consumed, communitywide, from renewable energy sources by 2050 (Minneapolis Sustainability, 2017; Office of Environment and Sustainability, 2017). St. Louis, MO, and Cleveland, OH, have committed to transitioning to 100% renewable energy generation by 2050, while Lowell, MA and Washington, DC have committed to doing the same by 2035 and 2032 respectively (Department of Energy and Environment, 2018; Department of Planning and Development, 2019; Office of Sustainability, 2017; Sustainable Cleveland, 2018).

The City of Cleveland is uniquely situated as the only city with a public utility, which enables the city to transition to renewable energy generation more effectively, as is discussed below. The other cities foster cooperative relationships with their private energy providers and are aided in some cases by state renewable energy portfolio standards that are more extensive than Ohio's standards. These cities also combine community solar projects with large scale utility renewable energy projects to lower costs and reduce the amount of utility scale energy required for a successful transition. Most larger cities, including most of the cities studied in this report, are incapable of producing enough energy locally to satisfy demand. While reducing energy demand and increasing efficiency are essential in all of these plans, most cities find it more feasible to purchase RECs and enter into power purchase agreements with out-of-state renewable energy generating utility companies (Department of Energy and Environment, 2018; Minneapolis Sustainability, 2017; Office of Environment and Sustainability, 2017; Office of Sustainability, 2017).

100% renewable energy for local government operations by 2030.

Similarly, a goal of reaching 100% renewable energy for local government operations by 2030 should be set, and the commitment should be formalized in a city council resolution. Greenprint for Akron recognized, as have the cities studied in this report, that local governments must lead in the transition to more sustainable and resilient communities. The City of Akron has authority over its operations and may more easily take climate actions and implement sustainable policies that deal exclusively with its own environmental footprint. At the same time, local government operations are more easily studied and comprise only a fraction of the total GHG emissions produced by the City of Akron, making the task of transitioning to 100% renewable energy more manageable.

The City of Akron can also use the local government transition as a useful, cost-effective platform for experimenting with different policies or actions as well as piloting projects that can be implemented on a broader scale in the City of Akron. Recommendations for achieving these goals will follow in a later section.

Some of the cities studied in this report have made commitments to transition government operations to 100% renewable energy by a date earlier than the one set for the communitywide energy transition. Lowell has set a target of 100% renewable energy generation for government operations by 2035 while Minneapolis has committed to achieving the same goal by 2022 (Department of Planning and Development, 2019; Minneapolis Sustainability, 2017). While all of the cities plan to transition government operations, these cities view an earlier government transition as a beneficial and useful tool for gaining community support and improving the climate policy implementation process.

Zero waste by 2040.

It is also recommended that the City of Akron pass a resolution that commits the city to a goal of reaching zero waste by 2040 or 2050. Though a similar goal of zero landfill was included in Greenprint for Akron and ReWorks' (formerly the Summit/Akron Solid Waste Management Authority) vision statement and Solid Waste Plan, zero-waste is considered to be a more desirable and sustainable goal for waste management (Summit ReWorks, 2016). "Zero-landfill" allows for the incineration of waste products for disposal and electricity generation, which neither reduces waste production nor completely eliminates landfill use (U.S. EPA, 2017). "Zero-waste" is a more sustainable and environmentally conscious goal which requires regions to divert most (upwards of 90%) of waste products from landfills and other waste disposal sites (U.S. EPA). While the diverted waste can be recyclable, compostable, or biodegradable, the minimal amount of non-recyclable, non-compostable, and non-biodegradable waste left over is typically landfilled or used for electricity generation until all waste production is eliminated.

Regions have experimented with various approaches to eliminating remaining waste production. One such approach involves communicating with manufacturers and producers of these waste products to encourage them to replace their products with biodegradable or recyclable material. Included with this goal, as will be discussed later, is a reduction of overall waste and recyclable material generated by reducing initial consumption and increasing the reuse of products and materials.

Improve Public Outreach and Transparency

Online design and accessibility.

It is recommended that the City of Akron make an effort to modernize and streamline their online services, media communications, and contact with city residents. Updating the aesthetic quality of city websites can have practical benefits, while simplifying website navigation can allow residents, visitors, and prospective buyers to get the information they need more easily. Similar to Akron Drives and Akron Waterways Renewed, the City of Akron's website should make it easy to view news updates and other posted information. Moreover, consolidating these websites under an improved City of Akron website with easily noticed and accessible links is preferable, as it offers the most user-friendly format for all internet users. Creating a separate page dedicated to reporting information related to sustainability, resilience, and other climate or "green" topics would make it easier for residents to gain information about Akron's actions on climate and remain updated on the city's progress towards its sustainable goals.

Communications and social media.

These efforts should be complimented by social media campaigns designed to increase city transparency and community outreach so that residents are continually informed about the state of sustainability in the City of Akron. There is real, practical benefit to ensuring residents not only have easy access to this information, but that they actually see it or are made more aware of it. Minneapolis, MN, Cleveland, OH, and Washington, DC each have dedicated pages or websites for their respective sustainability departments or offices to post information and track

progress towards targets. Similarly, these cities employ social media as a useful tool for community outreach and engaging with the public.

Tracking targets.

As part of the City of Akron's outreach efforts, it is also recommended that the Green Ribbon Panel (or other sustainability focused body) continually, among other duties, report on the City of Akron's progress towards the stated goals of zero carbon, zero waste, and 100% renewable energy. This should involve the utilization of systems that accurately track progress on these goals so that, at a minimum, the City of Akron and the Green Ribbon Panel can produce reports detailing that progress annually. These tracking systems will require accurate and timely measures of energy use, energy efficiency, waste generation, and so on. The following recommendation provides a partial mechanism for acquiring and tracking these measures.

Mandatory Disclosure, Benchmarking and Ranking

In order to more accurately track the effect of energy efficiency measures and energy consumption reductions, it is recommended that the City of Akron introduce policies requiring the regular disclosure of energy use and energy efficiency data by the city as well as commercial, industrial, and residential sectors. This will allow the city to identify the largest energy users, identify areas where energy efficiency is low, and keep track of compliance with energy reduction and efficiency goals. Benchmarking and ranking systems as well as disclosure requirements should be specific to individual sectors, and should distinguish between actors within those sectors based upon size and ability to comply with the requirements in order to ensure that requirements are neither burdensome nor ineffective. For instance, Washington, DC mandates that all buildings larger than 50,000 square feet report their annual energy use data to

DC's Department of Energy and Environment, where buildings are ranked according to their relative efficiency and energy use intensity (Department of Energy and Environment, 2018). This information is also presented in a useful interactive map, allowing businesses and the general public to visualize and compare building energy use.

Waste production and recycling disclosures and benchmarks.

It is also recommended that the City of Akron explore requiring that commercial and industrial businesses and other organizations report their waste generation and recycling trends. This will allow the City of Akron to similarly track the largest sources of waste generation and develop policy that effectively reduces or eliminates waste that is not recyclable, reuseable, compostable, nor biodegradable (U.S. EPA, 2019a).

Revise Zoning Codes

While the City of Akron has continued to encourage changes to its zoning codes in order to create development opportunities and spur more progressive, purposeful land use, these changes have tended to be modest and limited to specific target areas and development projects. Reevaluating Akron's zoning codes and introducing progressive and sustainable zoning codes, while removing codes which impede or conflict with these goals, will ensure current and future development is reflective of best practices in urban zoning. Zoning codes can also be employed to help reduce opportunities for continued urban sprawl by reserving acquired suburban land for urban farming, greenspace, or community hubs (Jones & Kammen, 2014). St. Louis and Lowell implemented progressive zoning laws aimed at encouraging placemaking in addition to increasing infill and multi-use buildings (Department of Planning and Development, 2013; Office of Sustainability, 2017). Care must be taken to ensure rezoning does not impact the

culture and cohesion of communities. Changes in the zoning code can often spur gentrification that displaces or alienates historically minority cultural centers. Sustainable Cleveland built into Cleveland's CAP a racial equity tool that checked against such unintended effects (Sustainable Cleveland, 2018).

Revise Building Codes

Similarly, City of Akron Building Codes should be revised to reflect up-to-date sustainability standards and best practices. As the city pursues redevelopment and rebranding efforts, it is crucial that building and infrastructure projects meet recognized standards of sustainability. Incorporating complete green streets ordinances into Akron's building code is a good first step to ensuring Akron becomes a more sustainable city. However, more revisions are necessary to ensure the city's built environment continues to become more sustainable.

Building standards.

Recommended changes include incorporating Leadership in Energy and Environmental Design (LEED), Energy Star or similar nationally and/or internationally recognized sustainable, green building standards into the city's building code framework. These standards are widely recognized as good practices for increasing the environmental sustainability and reducing the overall carbon footprint of buildings and infrastructure, while maintaining the cost effectiveness of projects. A tiered incentive system could be fitted to these building standards that could encourage more sustainable building projects while not necessarily discouraging development by entities that are unable to meet higher building standards. However, it is necessary to adopt a minimum building standard that is still reflective of reasonable sustainability improvements that go beyond the standards set by the State of Ohio. A set of codes similar to stretch energy codes

used by the City of Lowell, MA would enable the City of Akron to set its own standards within specific areas of building design and construction (Department of Planning and Development, 2013). Washington, DC adopted some of Energy Star's energy efficiency standards for use in the district's building codes as well (Department of Energy and Environment, 2019).

In order to best serve the unique needs and conditions of the City of Akron, it's commercial and residential interests, it may be preferable to craft an Akron Green Building Standard Handbook, modeled after Cleveland's Green Building Handbook, that incorporates multiple rating systems and tailors requirements to the specific needs and desires of the City of Akron (Sustainable Cleveland, 2018). Systems of standards tend to be broad in order to accommodate a wide variety of structures and environments, so crafting a unique set of standards specific to the environment and characteristics of the City of Akron would improve the fit of these codes to Akron's community.

Green infrastructure.

Included with these standards should be explicit requirements for the incorporation of green infrastructure and greenspace into the design and construction of projects, with optional incentives encouraging on-site renewable energy generation. The City of Akron should, for instance, adopt policies that require all flat-roofed buildings larger than a certain size to incorporate green roofs, cool roofs, or solar photovoltaic panels into their design. Such a policy should be retroactive, but allow owners and operators of existing buildings a reasonable timeframe for making the necessary improvements. Project Sunroof estimates that the City of Akron has approximately 30.5 million square feet of flat roofing within its geopolitical boundaries (Google, 2018). Covering this space alone with solar photovoltaic panels would

yield a yearly energy generation potential of 487,200 MWh, which is roughly 8.8% of the City of Akron's estimated total energy consumption for 2016 (Google, 2018).

In addition, codes should specifically encourage adaptive reuse of buildings over demolition, wherever possible, as this significantly reduces waste and carbon emissions associated with new building projects. The city should also consider the feasibility of requiring all or a portion of all renovation and reconstruction projects to meet similar minimum standards. Similar to Complete Green Streets, "complete building standards" could require that a host of specific updates or retrofits be made regardless of the scope of a renovation project. This is especially important for aging, less sustainable buildings and infrastructure that can gain much from increased energy efficiency. Lastly, included in these codes should be provisions for the sustainable operation of buildings and infrastructure through on site recycling and composting programs, waste and consumption reduction, and other sustainable practices.

Inspections

It is recommended that the City of Akron change city ordinances to require that mandatory residential and commercial building inspections include measures of water, energy, and building efficiency. This can incentive buyers to make conscious decisions about the sustainable nature of their potential purchases, while also incentivizing sellers to invest in energy efficient and energy conserving systems that are marketable and attractive to buyers. This policy would compliment other benchmarking and ranking systems, such as Washington, DC's benchmarking system discussed above (Department of Energy and Environment, 2019). Care must be taken to ensure that such measures do not disproportionately impact people who are less able to afford such upgrades or who are less able to afford purchasing property with these

upgrades. This policy should be complemented by city and community programs that make it easier and more affordable for low income residents to invest in electrification and resource efficient upgrades.

As this policy makes the energy efficiency of buildings more explicit in the value calculations of properties, it would provide a basis for expanding Akron's Residential Property Tax Abatement program to include the installation of energy efficient appliances and fixtures as well as solar energy or solar thermal generation systems (Department of Planning and Urban Development, 2017).

Local, Regional and State Collaboration

It is recommended that the City of Akron collaborate with Cleveland, Cincinnati, and other Ohio cities that have committed or soon will commit themselves to similar sustainability goals. A network of cooperation and assistance would not only be beneficial to all parties involved, but would also allow collaborators to leverage their combined clout against state legislators and the governor's office for more favorable state policies.

Lobby state and federal governments.

It is recommended that the City of Akron lobby the Ohio state legislature and the Governor's office for additional financial assistance, to lift the freeze on renewable energy technologies in Ohio, and to support the adoption of more sustainable renewable energy portfolio standards (Public Utilities Commission of Ohio, 2019). The City of Lowell and other municipalities in Massachusetts collaborated with the state government to implement statewide renewable energy standards and carbon emission reduction requirements, as well as a statewide

system for monitoring progress towards state mandated targets (Department of Planning and Development, 2019).

Revive Summit County's green team and policy task force.

The revival of Akron's Green Ribbon Panel would be well complimented by revival of the Summit County Green Team. Both government bodies were originally products of Greenprint for Akron and they could work intandem on current climate action and sustainable goals (Carmen et al., 2012). St. Louis, Minneapolis, and Cleveland each are situated in counties that also have dedicated sustainability departments that compliment city sustainability efforts (Minneapolis Sustainability, 2017; Office of Sustainability, 2017; Sustainable Cleveland, 2018)

Increase Tree Canopy Coverage and Green Space

While Akron's Urban Tree Canopy (UTC) is extensive compared to similar cities, the City of Akron should commit itself to increasing tree canopy coverage beyond 40%, to 50-60%. Especially in low-income neighborhoods where tree canopy coverage is the lowest, increased planting and reforestation can produce substantial benefits to the community (Plant-It GEO, 2013). Research even indicates that well maintained and abundant green space produces modest reductions in crime (Mennis & Wolfe, 2012).

Trees sequester carbon and forests serve as carbon sinks, so increasing Akron's UTC will assist the city in reaching carbon neutrality by 2050. UTCs also improve air and water quality and provide shade and insulation that reduce building energy costs, thus planting more trees and increasing green space can deliver public health and financial benefits (Plant-It GEO, 2013). Green space in the form of community gardens or edible fruit producing trees and plants also have benefits that are discussed in the section below. Due to these and other benefits, this report

recommends that the City of Akron increase green space in those neighborhoods where the benefits of added trees and greenspace will have the greatest impact. The city should strive to make tree canopy coverage equitable across all Akron neighborhoods while working towards increasing overall UTC coverage to 50-60%. The City of Cleveland is pursuing aggressive reforestation operations that aim to restore Cleveland as the “Forest City” (Sustainable Cleveland, 2018).

Create an Urban Food Production Plan

It is recommended that the city of Akron create a Food Production Plan with the goal of developing a path towards increasing the production and consumption of local foods to 25% by 2050. This plan would act in conjunction with other assessments, such as a Community Food Assessment, detailed below. Growing more food locally increases the availability of cheap, healthy food for low-income and vulnerable people, supports local businesses and residents, keeps economic benefits and profits within the Akron area, creates green space and beautifies the region, supports the transformation of vacant and unused property into productive farming use, increases carbon sequestration when best farming practices are utilized, and benefits animal and insect populations (Department of Energy and Environment, 2011). Washington, DC’s CAP sets many food and farming related targets, including increasing the city’s consumption of local foods to 25% (Department of Energy and Environment, 2011).

Care must be taken to ensure that sustainable horticultural techniques are employed in order to maximize the longevity, sustainability, and environmental benefit of these farms. It is also important to apply an equity framework to ensure that health and economic benefits are realized by all local communities and residents, especially low-income, vulnerable, and minority

communities. Urban farming should not degrade soil health or contribute excess GHG emissions, nor should produce and food from these local farms be disproportionately consumed by restaurants and wealthy residents.

Community food assessment.

It is recommended that the City of Akron conduct a Community Food Assessment that explores the food options available to neighborhoods and studies the food-purchasing behaviors of residents. As in other areas of this report, it is absolutely essential that policies geared towards enhancing the quality of life of Akron residents are thoroughly examined, especially with respect to how they impact low-income, minority and vulnerable communities. A Community Food Assessment would be able to measure the food purchasing and sourcing habits of residents as well as the access residents have to local food markets. In this way the City of Akron would be able to assess the benefit and reach of current policies while identifying gaps where further policies or development are needed.

Food security is also an indicator of the socioeconomic benefits of climate action policies discussed above. A comprehensive community food assessment would much more accurately be able to measure the food insecurity of Akron residents within each neighborhood. The City of Cleveland and Cuyahoga County conducted a community food assessment that assessed the relative access to healthy and inexpensive sources of food for neighborhoods and residents facing a variety of situations (e.g. lack of transportation)(Sustainable Cleveland, 2018).

Reduce Waste***Reduce food waste.***

The City of Akron should help expand local food donation and collection efforts through the Akron-Canton Regional Foodbank in order to make it easier for businesses and restaurants to donate unused or excess food that would normally be wasted. In addition, the city should help increase the capacity of the Foodbank and other local organizations to reach low-income and vulnerable families throughout Akron (Ohio Environmental Protection Agency, 2019).

Trash service fees, pay-as-you-throw.

It is recommended that the City of Akron increase garbage collection fees under a “pay-as-you-throw system” where commercial and industrial businesses are charged collection fees based upon the weight of their waste products in order to incentivize the reducing, donating, composting, or recycling of waste products. The city should assist businesses and restaurants with developing better production and waste management plans that prioritize reducing initial stock and production of goods, while also encouraging the selling or producing of products that are recyclable, reusable, or biodegradable. These efforts can also be complemented by increased opportunities for donating or recycling waste products. Additional revenue gained from increased garbage collection fees should be applied to expanding the processing and recycling of materials at the City of Akron’s waste management and recycling centers. Lowell, MA and Washington, DC have instituted similar pay-as-you-throw schemes that are projected to save the cities money and reduce commercial and industrial waste going to landfills (Department of Energy and Environment, 2011; Department of Planning and Development, 2013),

Divert food and other organic waste, community composting.

Where food waste cannot be donated and consumed and organic waste is funneled into the garbage, the City of Akron should consider the implementation of community and municipal composting programs. Diverting organic waste products from landfills and incinerators to composting programs can reduce both waste production and excess GHG emissions. Composting can also provide communities and the city with fertilizer that can be used in community gardens, flowerbeds, and urban farms, or can be sold to local businesses and residents.

Increase Energy Efficiency

Reducing overall energy use by increasing energy efficiency is essential if the City of Akron is to reach the goals of zero-carbon and 100% renewable energy generation. More efficient use of energy should be complemented by increases in overall building efficiency and the incorporation of green infrastructure and green building designs into existing buildings and planned development projects.

Efficient and reduced energy use.

In addition to other policies requiring that construction, renovation, and rehabilitation of buildings meet certain energy efficient standards, the City of Akron should partner with Ohio Edison, First Energy, and other organizations to expand the availability of energy efficient products at reduced costs, such as LED lights or appliances

Electrification

The City of Akron relies heavily on the use of natural gas, gasoline, and other fuels across all major sectors: residential, commercial, industrial, and transportation. In order to reach 100% renewable energy and zero-carbon, Akron must make efforts to transition these sectors

from fuel intensive operations to electric operations. National rates of electrification are low and few cities have pursued specific electrification schemes that go beyond market-based incentives that deal primarily with the transportation sector (Jadun et al., 2017). Most model cities concentrated on shifting to fuels, like natural gas, that produce less emissions. Cincinnati was the only city studied that planned to reduce the use of all fossil fuels by a significant amount, however, those policy recommendations were exclusively aimed at curbing emissions from the transportation sector (Office of Environment and Sustainability, 2018). While the transportation sector in the United States is the third largest contributor to GHG emissions, it is the least electrified and the same is true within the City of Akron (Carmen et al., 2012; U.S. Department of Energy, 2019).

Thus, while the transportation sector offers the most space for improvement with regards to electrification and emission reductions, creating a sustainable city requires Akron to boost electrification rates across all sectors through creative and ingenuitive means. This is not to say that market based incentives should not be employed; the City of Akron should pursue policies that encourage the purchase of electric vehicles, support greener public transit, expand bike use and ride sharing, and reduce emissions from idling. However, these alone are not enough to eliminate the use of fossil fuels within the City of Akron. As the goal of zero-carbon is the most difficult and has the longest time frame, the City of Akron should continue the implementation of policies outlined in Greenprint for Akron with regards to greening and electrifying Akron's transportation sector. It is also recommended that the City of Akron explore the feasibility of electrifying all sectors by 2080.

Renewable Energy Generation

Effective carbon reduction measures must include renewable energy generation on a large scale. While improved energy efficiency and reductions in overall energy demand can and have reduced Akron's electricity consumption, the complete elimination of carbon emissions necessitates the pursuit of 100% renewable energy generation. Though opportunities may arise for the implementation of wind, geothermal, or other renewable energy technologies, this report will deal exclusively with the implementation of solar energy generation. Because Ohio's rollback of its renewable energy standards has made large scale wind energy generation temporarily impossible, and because nuclear energy generation is nonrenewable, expensive, and declining, solar energy generation is Akron's best and most immediate option for pursuing renewable energy and zero-carbon goals (Jin & Kim, 2018).

Distributed community energy generation.

It is recommended that the City of Akron encourage and support the implementation of community rooftop solar installations. Whether through private installations or community solar cooperatives, community based renewable energy generation provides a relatively simple path towards a partial renewable energy transition. Distributed community energy generation also offers a host of benefits, including partial energy independence, energy grid stability and security, reduced utility burdens, and increased economic development (U.S. EPA, 2018b).

The city should work to connect Akron residents, businesses, organizations, and communities with renewable energy companies that offer leasing or lease-to-own options for solar photovoltaic panel installations. The Cities of Minneapolis and Lowell, for instance, have compiled comprehensive information packages for residents that explain solar system

installations and their costs and benefits, and provides information for local solar installation companies (Department of Planning and Development, 2013; Minneapolis Sustainability, 2017). Entering into communitywide agreements with solar installers may also reduce installation costs, as residential rooftop solar is generally more expensive to install than large scale solar systems.

Local government renewable energy generation.

The Greenprint for Akron CAP recommended the installation of solar photovoltaic panels on some municipal buildings and community centers in order to reduce carbon emissions from city operations as well as to serve as a model for further solar installations throughout the City of Akron (Feezel et al., 2009). Few such installations have been installed to date, which has hampered the city's progress towards reducing local government emissions and stalled further discussions around the adoption of renewable energies in the City of Akron. It is recommended that, following the adoption of a resolution committing the city to transitioning local government operations to 100% renewable energy, the City of Akron pursue and expand upon the recommendations laid out in Greenprint for Akron with regard to local government energy generation and reduction. The City of Akron should commit itself to covering municipal and city-owned buildings and parking decks with solar photovoltaic panels. Where structures are unsuited for solar photovoltaic panels, the city should utilize cool roof, green roof, or other green infrastructure designs.

City rooftop solar could significantly reduce GHGs emitted by local government operations while saving the City of Akron money and providing local organizations and residents with a blueprint for installing similar systems. As discussed above, if the City of Akron implements and carries out these policies, it will be in a position to serve as a model and source

of information for the rest of the Akron community. This would be especially useful for guiding improvements that the city mandates residents and businesses make (e.g. mandatory installation of cool roof, green roof, or solar photovoltaic panels on flat roofs larger than a specified size).

It is also recommended the the City of Akron consider and explore the installation of small-scale solar arrays on brownfields, including landfills, in and around the geopolitical boundaries of Akron. The closed Hardy Landfill, for instance, could be utilized for a small-scale solar installation that does not require land revitalization procedures. This could provide the City of Akron with a cost effective scheme for reusing land that is currently unfit for residential or commercial development. Cincinnati's CAP includes plans to install several solar systems on municipal owned property, including a 25 MW installation on the closed Center Hill landfill (Office of Environment and Sustainability, 2018). The city will either finance the project itself or will lease the land to a private solar installation company that can capitalize on federal renewable energy tax incentives (Office of Environment and Sustainability, 2018). The City of Akron should consult the Northeast Ohio Four County Regional Planning and Development Organization and the Ohio EPA Division of Environmental Response and Revitalization for further guidance on planning and funding the development of solar energy generation systems on brownfields and other unfit land locations.

Utility-scale renewable energy generation.

While communitywide rooftop solar installations can reduce the demand for off-site energy production, they cannot reasonably eliminate it. Even with complete rooftop solar photovoltaic panel coverage, a substantial gap still exists between distributed community renewable energy generation and energy consumption, which will require utility-scale renewable

energy systems. This makes it necessary for the City of Akron to find ways in which renewable energy generation can be provided at such a scale. Considering electricity for the City of Akron is generated and distributed by a private utility company, Ohio Edison, a subsidiary of FirstEnergy, there are three main options that the City of Akron has available to it in order to achieve utility scale renewable energy generation: (1) encouraging Ohio Edison and FirstEnergy to transition their energy generation capabilities to renewable energy, (2) purchase RECs from credible energy providers, or (3) create a public municipal or cooperative electric utility either outright or through acquiring portions of Ohio Edison and FirstEnergy's generation and distribution systems.

Private electric utility.

The option to encourage or pressure Ohio Edison and First Energy to transition to renewable sources of energy generation is more practical and readily actionable than the third action. Through its electric aggregation program and as the site of First Energy's headquarters, the City of Akron does wield influence that should be leveraged in order to pressure Ohio Edison and First Energy into expanding their renewable energy portfolio. Partnering with surrounding municipalities and counties that are in favor of increased renewable energy generation is likely to substantially increase the leveraging power of the City of Akron. Regional collaboration on this matter is the best option, especially considering FirstEnergy and Ohio Edison have continued to use coal, natural gas, and nuclear power plants for energy generation.

In this scenario, much of the work involved in transitioning to renewable energy generation would fall on First Energy and Ohio Edison, though it is uncertain the extent to which their efforts would require raising energy use rates. The City of Akron and regional collaborators

could extend assistance to First Energy and Ohio Edison' transition efforts. Most cities, aside from the City of Cleveland, have sought to expand renewable energy generation by cooperating with their respective private utility companies. Whether Ohio Edison and First Energy are willing to enter into such corporations is not entirely clear and should be further explored.

Renewable energy credits, carbon offsets.

Renewable energy credits and carbon offsets offer the easiest, simplest, most readily actionable option for the City of Akron to transition to 100% renewable energy. As the city already participates in an electric aggregation program, Akron, as an aggregator, could purchase RECs that would offset some or all of the city's energy use (U.S. EPA, 2018a). This option, though available to the city, should only be used as a last resort for achieving Akron's sustainability goals. Purchasing RECs generally does not lead to an expansion of local renewable energy generation, and so few indirect benefits are gained. The City of Akron would neither gain new green technology jobs, nor would it realize the economic benefits and eventual savings of local renewable energy generation. For these reasons, this report does not recommend the use of RECs and carbon offsets except as a last resort and as a means of filling in the gaps after other policy options have been exhausted.

As discussed above, most model city CAPs include the purchasing of RECs and carbon offsets to achieve the various renewable energy and GHG emission reduction targets. In each case though, these purchases have been planned as a final means of reaching renewable energy generation targets.

Public municipal or cooperative electric utility, municipalization.

Though the process of establishing a public municipal or cooperative electric utility is long, complicated, and expensive, the benefits of a publicly owned utility are great and returns on investments are often realized within a short timeframe. Average costs to customers are generally lower under public utilities than private utilities, system operations are often much more adaptable, and response times are much shorter (American Public Power Association, 2019). As all profits from public utilities can be redirected back into the utility, renewable energy expansion becomes easier and more cost effective. While the specifics of municipalization are beyond the scope of this report, Akron and Ohio law do allow for the municipalization of some private entities, so it is recommended that the city of akron consider this recommendation as a viable option for achieving the goal of 100% renewable energy and zero-carbon (Akron Municipal Codes, 2019). A commission or steering committee could provide a platform for adequately assessing the feasibility and logistics of establishing and developing a public electric utility and navigating the legal channels of such an action. Whether the City of Akron creates its own public municipal electric utility that only partially replaces FirstEnergy's energy generation services, or whether the city attempts to lease, purchase, or condemn portions of Ohio Edison and FirstEnergy's electric generation and distribution infrastructure should be dependent upon the findings of a formal commission or steering committee.

A related option, and one which may prove more feasible, is forming a utility cooperative through regional collaboration. Such a cooperative could be created through either of the two scenarios detailed above: either as a new utility or by municipalization of pre-existing electric generation and distribution systems. As mentioned numerous times throughout this report,

collaboration between other municipalities, Summit County, and surrounding counties is vital and provides opportunities for sharing the cost and burden of climate actions that have a great deal of potential.

As the future of FirstEnergy Solutions is uncertain, there may be potential for the City of Akron and other regional leaders to leverage their combined purchasing power in order to acquire a portion of First Energy and its generation and distribution systems (Siegel, 2019). Thus, it is recommended that the City of Akron, through a commission or steering committee, explore the possibility of either leasing or purchasing a portion of First Energy's electric generation and distribution system in cooperation with surrounding municipalities and counties. From there, the City of Akron's Public Service department may work in conjunction with the Public Utilities Commission of Ohio to formalize the creation of a public electric utility and to set the operating guidelines for effectively generating and distributing electric power to the City of Akron and the surrounding region.

Increase Funding Opportunities

Finding and maintaining funding opportunities that support community efforts aimed at building sustainability and resilience is vital to the success of these efforts and the reaching of a zero carbon, zero waste, 100% renewable energy city. Most cities studied, and indeed most cities in the United States, including Akron, do not have the resources necessary to finance climate actions and policies alone. Thus, it is necessary for the City of Akron to find and create sources of funding that adequately meet the financial requirements of transitioning to zero carbon, zero waste, and 100% renewable energy. The City of Akron already capitalizes on state and federal assistance as well as grants from local, state, and federal agencies to cover its project expenses.

Akron Climate Action Fund

The City of Akron should partner with local community organizations and businesses, such as the Akron Community Foundation, the John S. and James L. Knight Foundation, and local hospitals, to create a Climate Action Fund modeled after Cleveland's Climate Action Fund. Similar to Cleveland Climate Action Fund, Akron's Fund should act as a "community-based, open-access carbon reduction fund" that allows local residents, businesses, and organizations to make monetary and in-kind donations that support local efforts to reduce Akron's carbon footprint and increase community sustainability and resilience (Sustainable Cleveland, 2018). These donations should be tax-deductible and should be advertised as a way to offset the carbon footprint of donors in order to incentive giving. In addition, fund grants should be coupled with certain requirements to ensure that projects which receive funds do reduce carbon emissions and improve local sustainability. These could include, among other things, requiring community projects seeking grants to first reach a certain level of community buy-in and support. This would more organically identify those projects that are favored by communities and which have the potential to gain more support, but care should be taken to provide all community projects with opportunities to gain visibility and support.

Community crowdfunding and matching donations.

The City of Akron should also consider incorporating an element of crowdfunding and matching donations into the Climate Action Fund. Cleveland's Fund partners with In Our Backyards to match donations dollar-for-dollar and incentivize crowdfunding efforts that challenge communities to reach fundraising goals (Sustainable Cleveland, 2018). The City of Akron along with the Akron Community Foundation should explore the possibility of expanding

matching donation schemes to incentivize continued community crowdfunding and sustained funding opportunities. Possible schemes could include partnering with crowdfunding organizations like In Our Backyards, matching donations with funds from the City of Akron and other local businesses or organizations, and encouraging businesses to create programs that match donations made by their employees. Matching funds can be limited to a certain dollar amount to ensure city or organization budgets are not negatively impacted by their commitment to match donations.

This has the potential to substantially reduce the cost of implementing sustainable climate actions to the City of Akron and may also spur further community climate action by distributing the responsibility for, work required for, and resources necessary for building sustainable and resilient communities. The City of Cleveland has met great success with its funding programs, so likewise, these projects have the potential to increase community awareness, involvement, and excitement about local green, sustainable initiatives as long as the City of Akron and its partner organizations effectively communicate these projects and funding opportunities to community members and Akron residents (Sustainable Cleveland, 2018).

Residential property tax abatement program.

The City of Akron's fifteen year, 100% tax-abatement policy for home improvements totalling over \$5000 specifically excludes on-site renewable energy generation as well as energy and water efficiency upgrades because they are unlikely to add value to the property (Department of Planning and Urban Development, 2017). Renewable energy technologies, specifically solar photovoltaic panels, as well as energy efficient upgrades to appliances and building fixtures do substantially increase the value of properties and should be included under the city's tax

abatement program. Research indicates that solar installations increase the value of homes, that the added value is nearly equal to the cost of the solar installation, and that buyers are willing to pay higher premiums for solar homes (Adomtis & Hoen, 2015; Fuerst & McAllister, 2011; Graff-Zivin et al., 2013; Kahn & Kok, 2014). For residents that can afford these improvements, the expansion of the property tax abatement program could encourage the installation of solar photovoltaic panels as well as energy efficient appliances, furnaces, water heaters, and weatherization upgrades.

Although Akron's property tax abatement program should be advertised to landlords and low-income homeowners, it is unlikely that this tax-abatement program will reach tenants in multi-family buildings and low-income homeowners. Thus, other tax incentives that either require a lower minimum improvement value or are specific to apartment buildings are better suited to reaching low-income residents and residents living in multi-family buildings. Further, the city should also consider whether a similar property tax abatement program aimed at commercial and industrial businesses would encourage those organizations to increase the sustainability of their buildings, operations, and fleets.

Savings, returns, and profit reinvestment.

Sustainable policies and climate actions, if implemented well, should provide direct economic benefits in the form of savings and returns on investments. It is recommended that the City of Akron formally earmark either all or a substantial portion of all accrued savings, returns, and profits from sustainable programs to be reinvested into sustainable initiatives, projects, and climate actions. This reinvestment should allow some of Akron's initiatives and programs to become partially or completely financially sustained.

Recommendations Beyond the Scope of this Report

This report is principally concerned with increasing the sustainability of the City of Akron while reducing its carbon footprint, and most recommendations listed provide the foundation for enabling the city to pursue those goals. However, the scope of this report is narrow, leaving much in the realm of climate action and policy left out. As such, the final recommendations of this report are for the City of Akron to explore the related climate issues of resilience in sustainable and social development, mitigation of and adaptation to climate disruption as correlates to sustainability, and socioeconomic equity in climate policy and climate action. Climate disruption exists as a systemic problem and so, naturally, a systematic and holistic approach to coping with and overcoming climate disruption is necessary.

Summary and Conclusion

To be a sustainable city requires that the City of Akron commit itself to achieving zero carbon emissions, zero waste generation, and 100% renewable energy generation. These goals are bold but promise sustained social and economic benefits in the short and long term.

Synthesizing the climate actions taken and climate policies implemented by six cities that share fundamental characteristics with the City of Akron yielded a list of recommendations, the implementation of which would lay the groundwork for substantial improvements to the sustainability of Akron. These improvements include, but are not limited to, increased energy efficiency and decreased energy demand, increased energy security and independence, reduced GHG emissions, reduced waste generation, improved public health, improved social wellbeing, increased public involvement and activism, and increased economic development and vitality.

The City of Akron has numerous options available for achieving these and other improvements. This report focused on several recommendations that comprehensively address the framework of zero carbon, zero waste, and 100% renewable energy. These recommendations, among other things, required the City of Akron to revive the Green Ribbon Panel and Greenprint for Akron CAP, as well as implement government policies that make taking climate action more effective. Some recommendations, importantly, involved Akron City Council passing resolutions that commit the Mayor and the City of Akron to specific target goals within specific time frames. Other significant recommendations included the revision of ordinances pertaining to building and zoning codes to require certain standards of sustainable building and development to be met. Recommendations suggesting climate action and climate policy that related to regional collaboration, tree and greenspace coverage, food and other waste reduction, energy efficiency,

electrification, community and utility renewable energy generation, and funding opportunities were also discussed within this report.

This report should serve as a guide to pursuing sustainability in the City of Akron and should be used to inform government policy and action relating to economic development. The findings of this report do not conclusively prove that climate action policies will produce beneficial economic and social outcomes, though there is reason to believe that long term benefits are possible. To that effect, the recommendations made in this report, if followed and implemented, are likely to provide the necessary foundation for pursuing climate action that has the potential to produce long term economic and social benefits. Further, this report identified several areas beyond the scope of the research where more exploration and research are could prove beneficial in Akron's transition to a more sustainable and resilient city.

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Appendix A - Figures

Figure 1: Akron, OH, Average Annual Temperature (1950-2019)

(NOAA National Centers for Environmental Information, 2019)

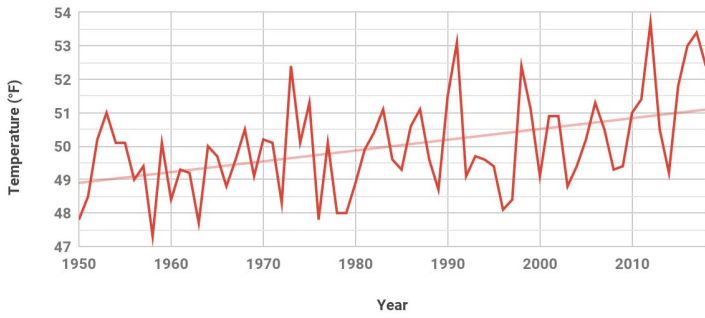


Figure 2: Akron, OH, Annual Precipitation (1950-2019)

(NOAA National Centers for Environmental Information, 2019)

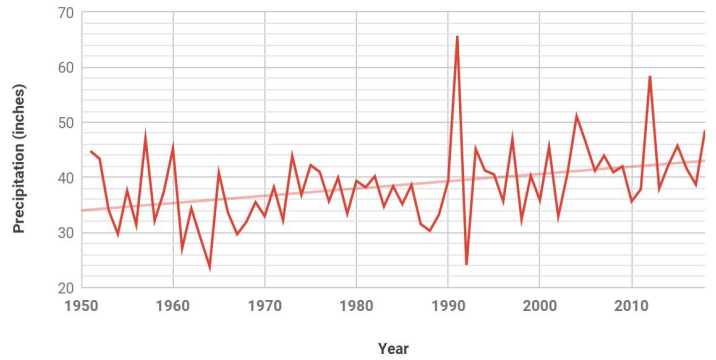


Figure 3: Ohio Valley Annual Climate Extreme Index (1950-2018)

(NOAA National Centers for Environmental Information, 2019)

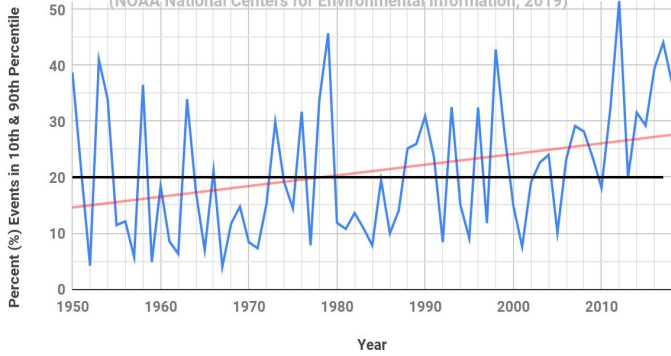


Figure 4: Ohio Valley Annual Extremes in 1-Day Precipitation (1950-2018)

(NOAA National Centers for Environmental Information, 2019)

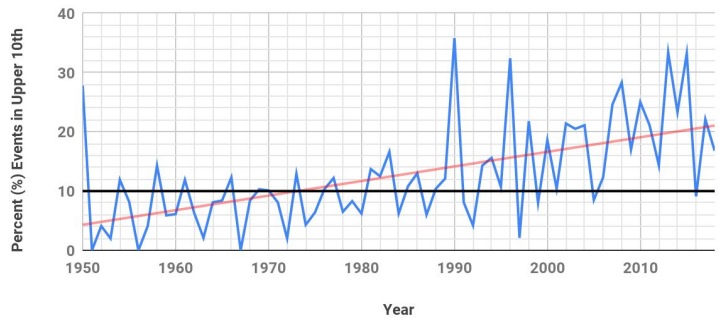


Figure 5: CO2e Emissions by Sector (2005, 2009 & 2016)

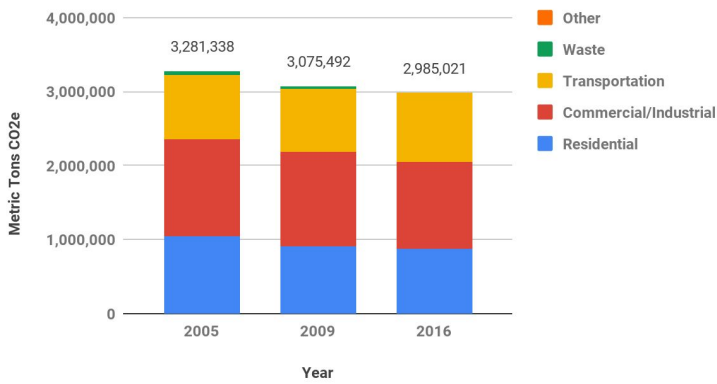


Figure 6: Electricity & Natural Gas Consumption for 2016

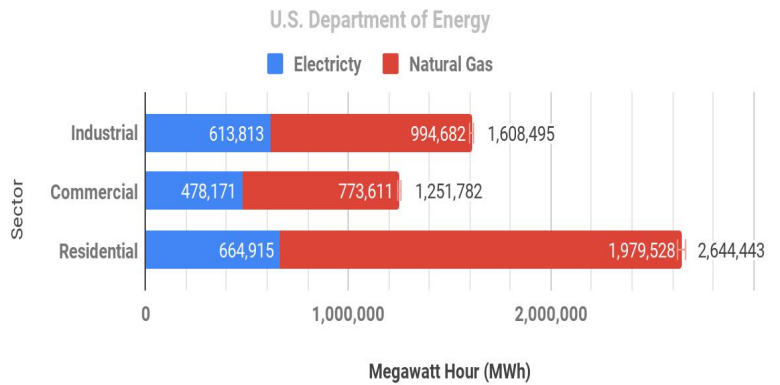


Figure 7: CO2e Assumed Reduction Scenarios

(U.S. Department of Energy, 2019)

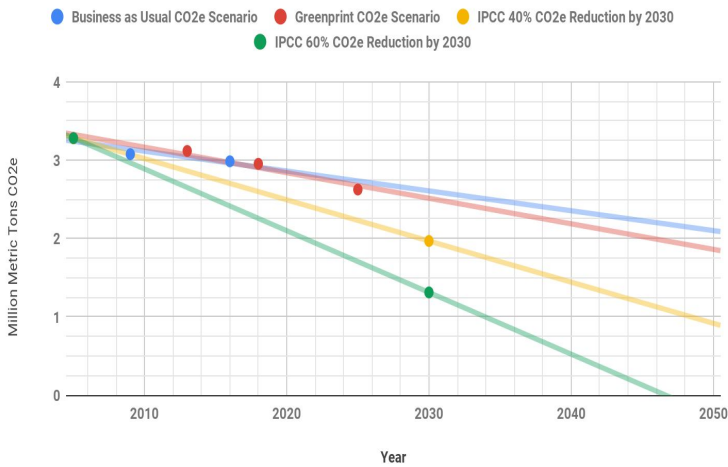


Figure 8: State & National Energy Consumption Trends

(U.S. Department of Energy, 2019)

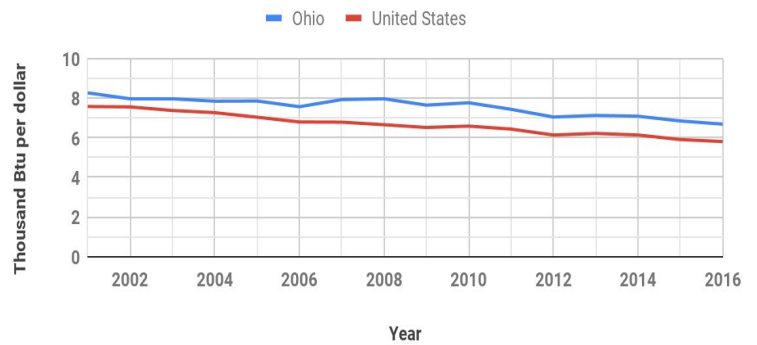


Figure 9: Recycling Rate for Summit County & the City of Akron

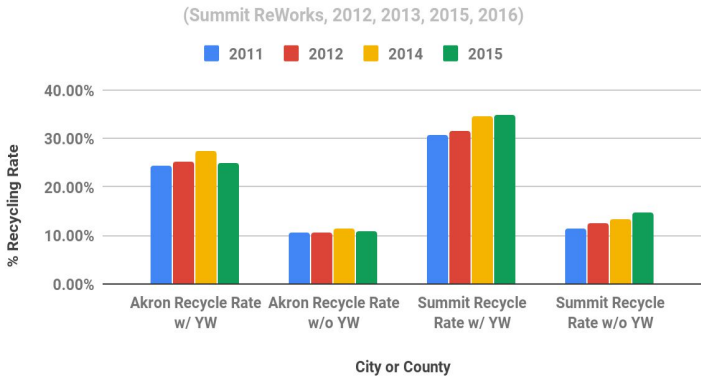


Figure 10: Projected Annual Rate of Waste Reduction: Total District Solid Waste

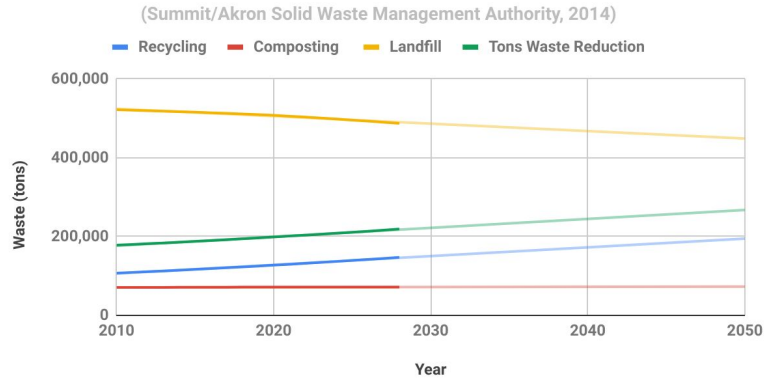


Figure 11: Total Installation Size (Akron)

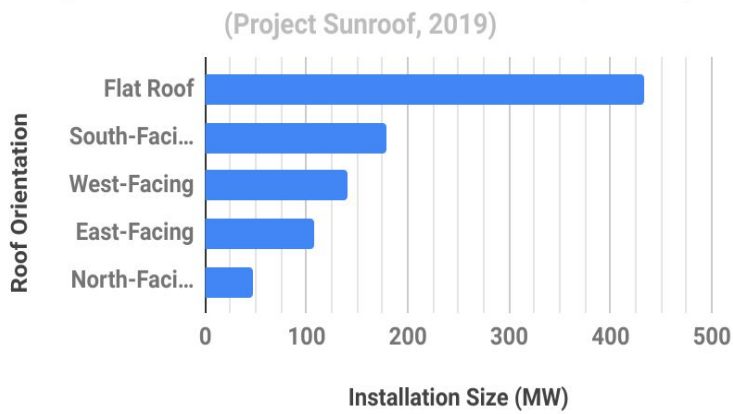


Figure 12: Total Yearly Energy Generation Potential (Akron)

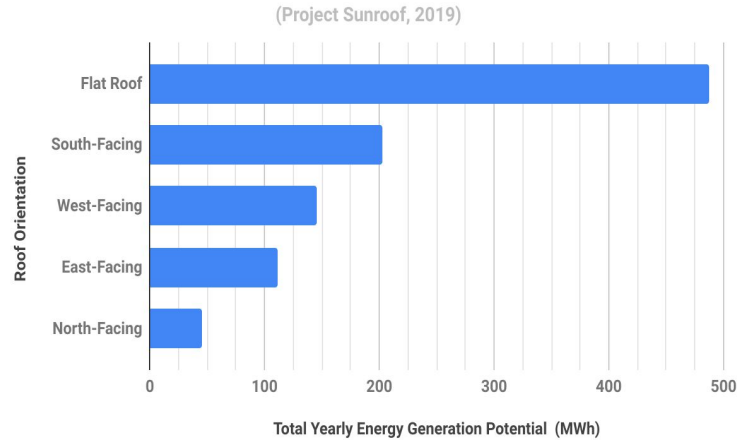


Figure 13: 90th Percentile Air Quality Index (AQI)

(Air Data, 2018)

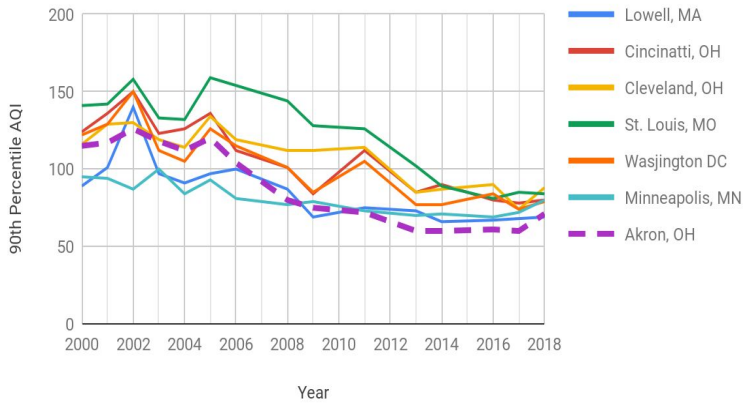


Figure 14: Percent of Families Below Poverty Line

(U.S. Census Bureau, 2017)

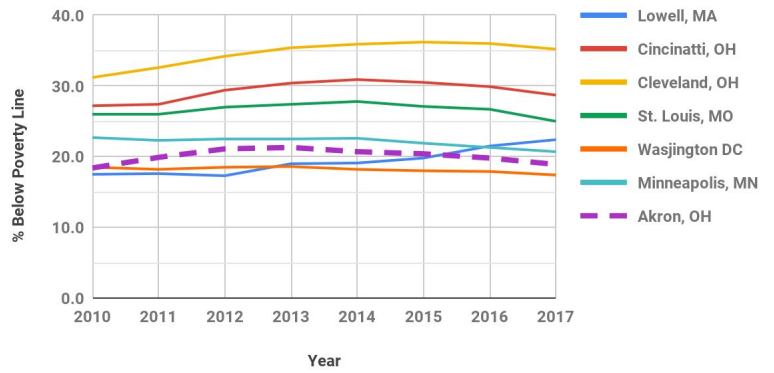


Figure 15: Median Household Income

(U.S. Census Bureau, 2017)

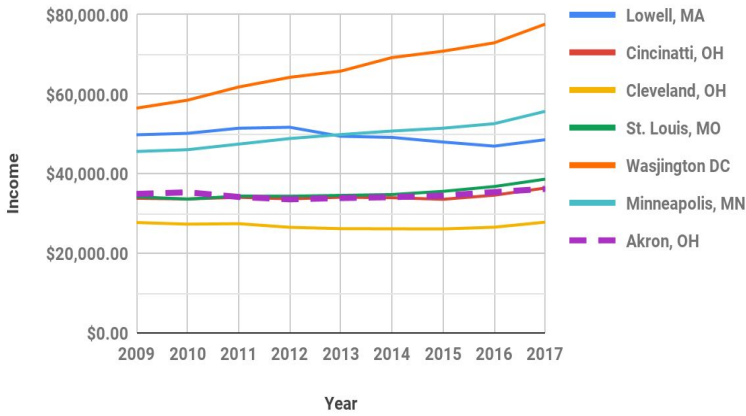


Figure 16: City-Data Crime Index (Combined Weighted Violent Crime & Property Crime)

(City-Data 2019)

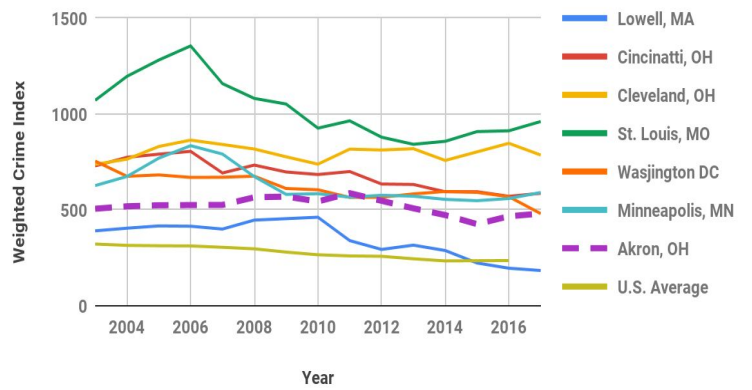


Figure 17: Percent Population w/ Low Access to Grocery Stores by County (2010 & 2015)

(Economic Research Service, 2017)

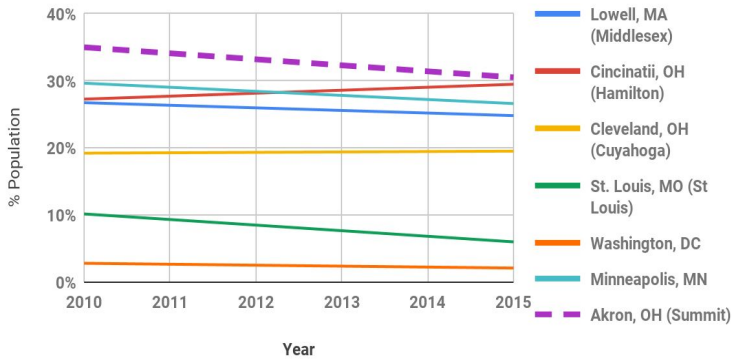


Figure 18: Percent Low Income & Low Access to Grocery Stores by County (2010 & 2015)

(Economic Research Service, 2017)

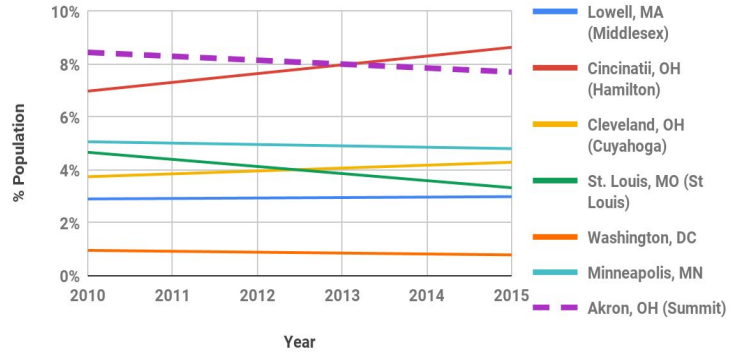


Figure 19: Grocery Stores Per 1000 People by County (2009 & 2014)

(Economic Research Service, 2017)

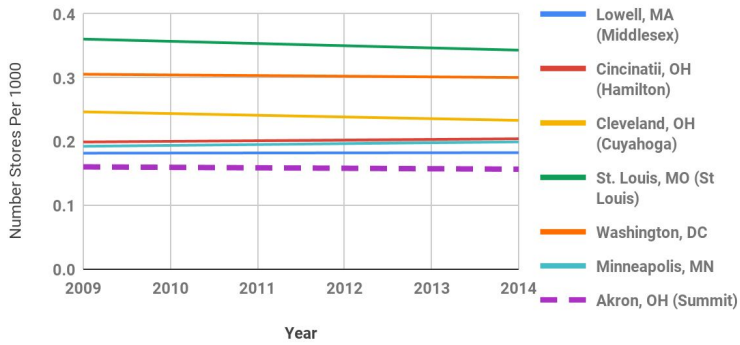


Figure 20: Farmers Markets Per 1000 People by County (2009 & 2016)

(Economic Research Service, 2017)

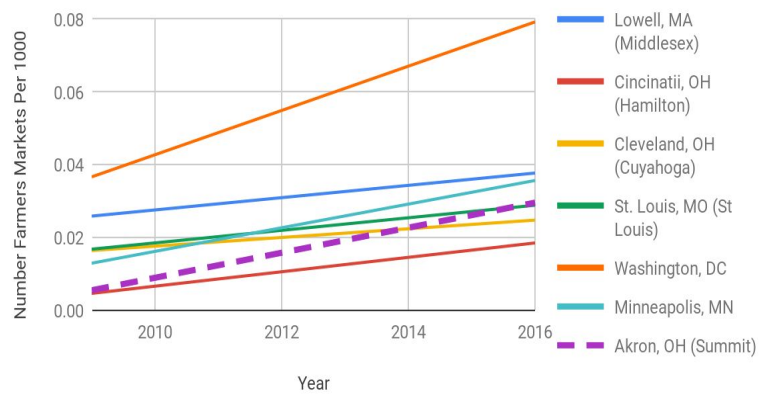


Figure 21: Food Insecurity Rate by County

(Feeding America, 2019)

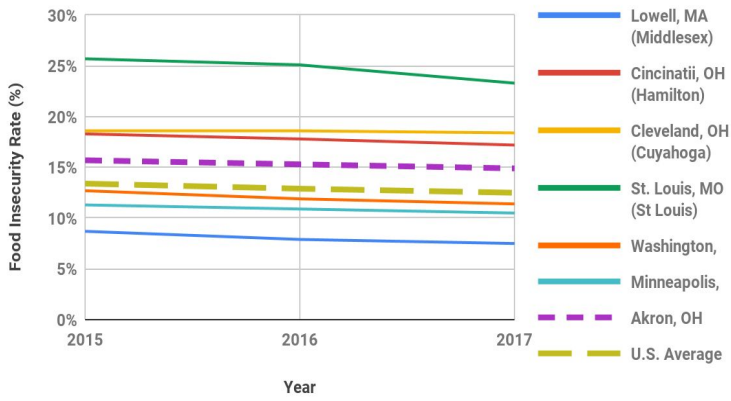


Figure 22: Overall Inclusion Rank

(Urban Institute, 2018)

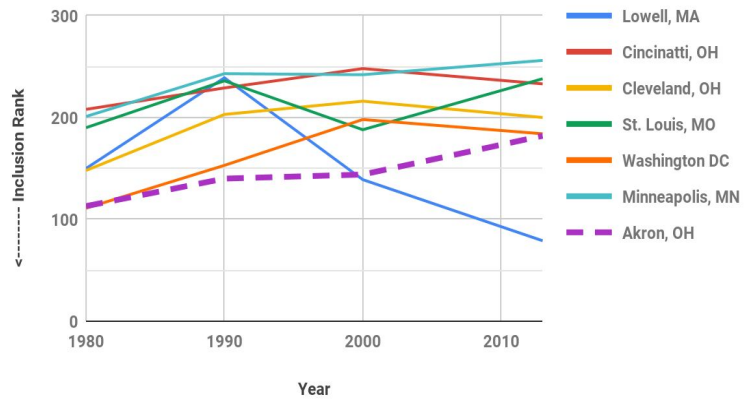


Figure 23: Racial Inclusion Rank

(Urban Institute, 2018)

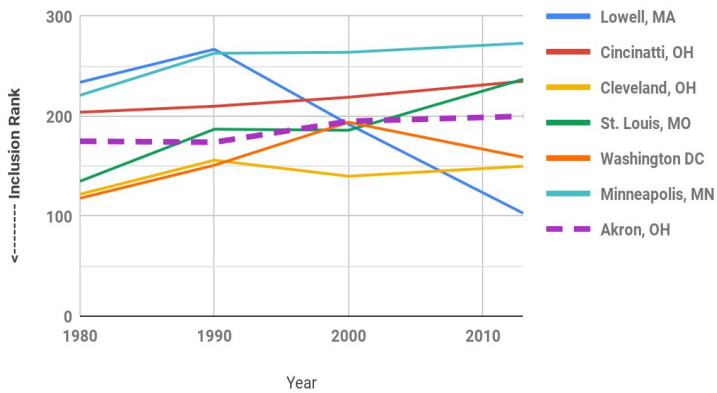


Figure 24: Economic Inclusion Rank

(Urban Institute, 2018)

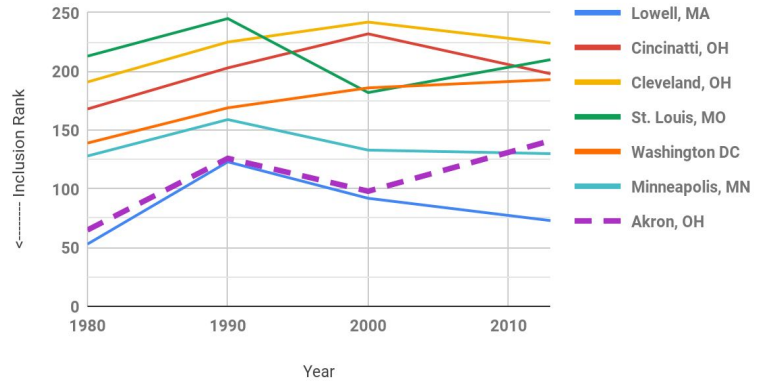


Figure 25: Economic Health Rank

(Urban Institute, 2018)

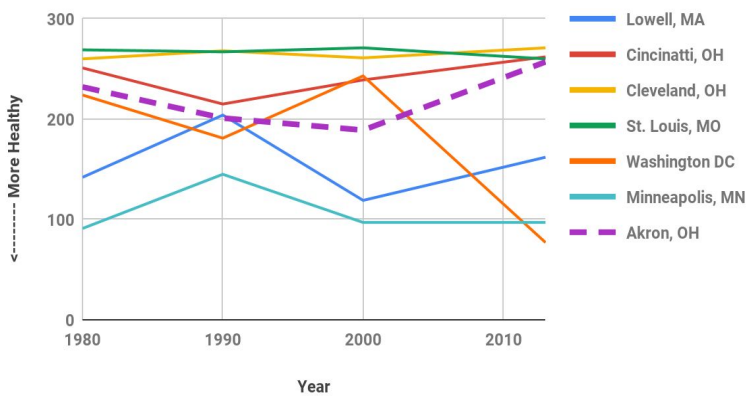


Figure 26: Solar Jobs by County

(The Solar Foundation, 2019)

