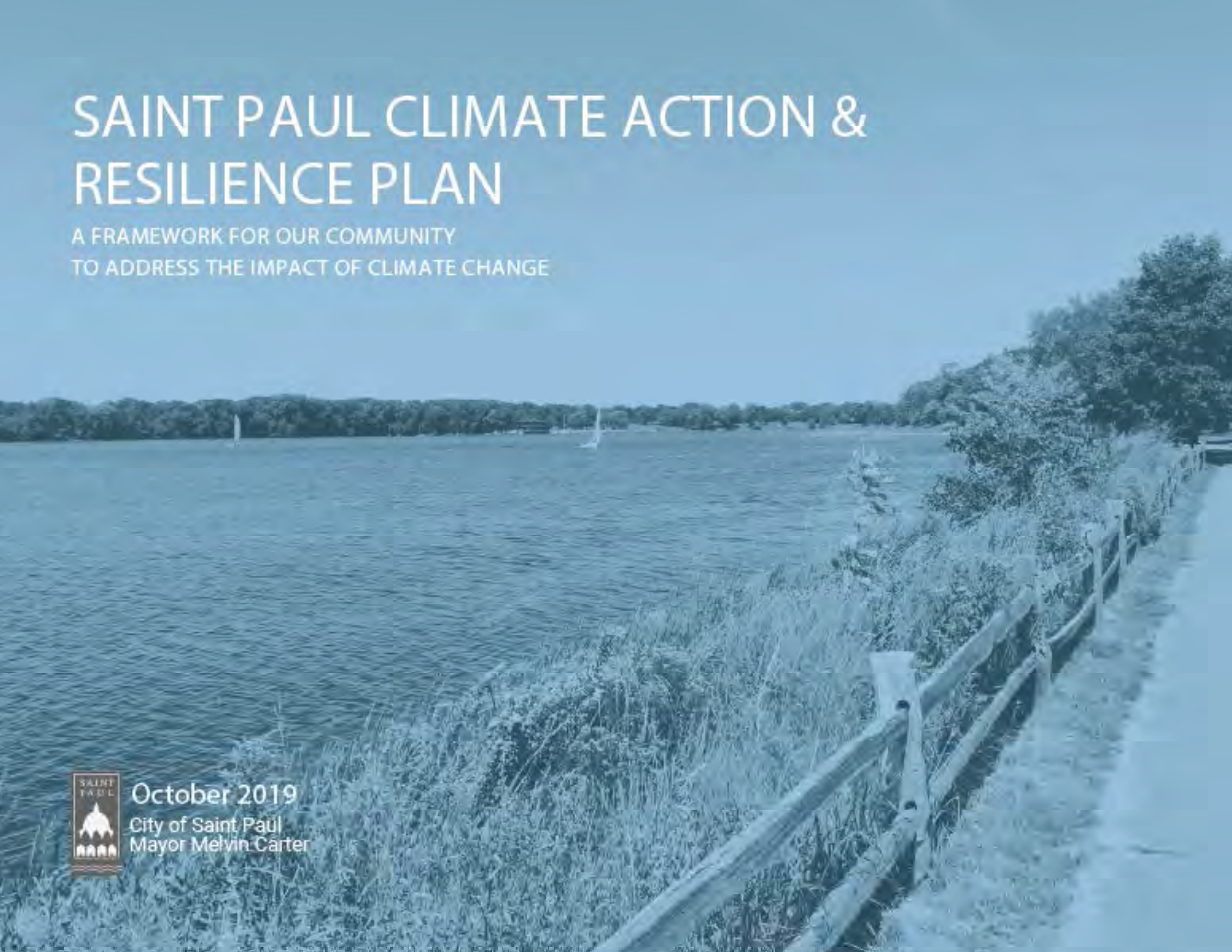
SAINT PAUL CLIMATE ACTION & RESILIENCE PLAN

A FRAMEWORK FOR OUR COMMUNITY
TO ADDRESS THE IMPACT OF CLIMATE CHANGE



October 2019

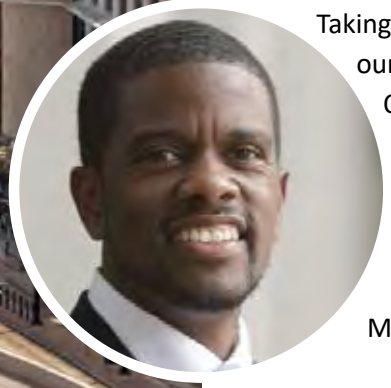
City of Saint Paul
Mayor Melvin Carter

LETTER FROM MAYOR CARTER

Photo Credit: Great Plains Institute

We are at a pivotal moment in the City of Saint Paul. To secure a successful future for all of our residents, we must work together to address the impact of climate change. In Saint Paul, we have been experiencing climate change for many years -- with warmer winters, more frequent heavy precipitation events leading to more frequent floods, rockslides, downed trees, and freeze-thaw cycles that are hard on our streets and infrastructure. Around the country and the world, communities are being increasingly affected by wildfires, floods, bigger storms, droughts, famines, and extreme heat waves.

Our collective effort as a community is essential if we hope to preserve natural systems that we depend on and for our health and well-being. With this bold new Climate Action and Resilience Plan, the City of Saint Paul will build on a long history of environmental stewardship with our residents, businesses, governmental units, and community partners. It focuses on strategies to reduce greenhouse gas emissions, which come from the energy we use in buildings, and the fuels that we use for transportation. To ensure everyone thrives as we become a more resilient city, the plan also identifies and prioritizes actions to help our most vulnerable populations, lower-income residents, and communities of color.



Taking bold and sustained action on climate change will require collaboration among our public-private sectors, neighbors, businesses, and community organizations. Our climate and resilience work will save critical resources, and most importantly, ensure we are building a prosperous, healthy, and livable city for our children and grandchildren. As we move forward together, I look forward to being your teammate in building an even more resilient and sustainable city that works for all of us.

Melvin Carter, Mayor

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Photo Credit: Great Plains Institute

ACKNOWLEDGEMENTS

The Saint Paul Climate Action and Resilience Plan is the culmination of extensive energy, effort, and passion on the part of the public, private, and nonprofit sectors, as well as community members from across the city. The City of Saint Paul extends a heartfelt thank you to all who contributed to this effort, without which this plan would not have been possible.

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This document includes photographs of two murals that are located in Saint Paul. The mural artists are:
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Special thanks to Anne Hunt and Ana Vang for all their efforts in building the foundation of this plan.

EXECUTIVE SUMMARY

Saint Paul is taking ambitious action to eliminate our contribution to global climate change by adopting a goal of carbon neutrality by 2050 and reducing emissions 50% by 2030 from business-as-usual (BAU). The city understands that the impact of climate change is already here, and it is necessary to prepare for anticipated disruptions. This plan includes both initiatives to mitigate greenhouse gas emissions and strategies to reduce vulnerabilities for a more equitable and resilient Saint Paul.

Despite increasing awareness around the impact of climate change from human activity, greenhouse gas (GHG) emissions continue to rise globally. **A recent climate report** shows trends toward more extreme climate scenarios than previously predicted. In Saint Paul, impacts are felt and observed most noticeably as extreme heat events, poor air quality, increases in frequency and severity of precipitation (both rain and snow), river flood events, ecological changes, and psychological impacts. These changes also have a disproportionately negative impact on vulnerable populations and historically marginalized communities of color. Through the development of this plan, Saint Paul is demonstrating that through climate action that focuses on efficiency, equity, and access to clean energy and mobility, it can cultivate a healthier, stronger, and more resilient city than before.

Resilience and Vulnerability

Saint Paul has already developed a **framework for community resilience**, and this plan builds on that work. For a community to improve its resilience, it must know what its vulnerabilities are. Climate change has the potential to have major impacts on people, the economy, and infrastructure — both built and natural. Certain populations, infrastructure, and natural assets can be more vulnerable to shocks and stresses depending on various factors including social characteristics, condition, and environment. For individuals, both situational and inherent characteristics, such as age and preexisting conditions, determine vulnerability. Geography, including proximity to highways and roads, vegetation, and water also vary the local and individual experience of climate change.

Natural infrastructure like trees, native plants, surface and groundwater, and beneficial species can be both susceptible to climate change and help improve the resilience of the city. The health of Saint Paul's urban forest impacts how climate change is experienced by location. Built infrastructure includes roads, bridges, water mains, sewer lines, energy distribution, streetlight networks, and buildings. Such infrastructure is vulnerable to damage during extreme weather events as well as sustained stress from freeze/thaw cycles, erosion, and extended heatwaves. Yet with the proactive approach that Saint Paul is adopting, there are numerous opportunities to grow and foster a resilient, sustainable city in which residents can thrive.

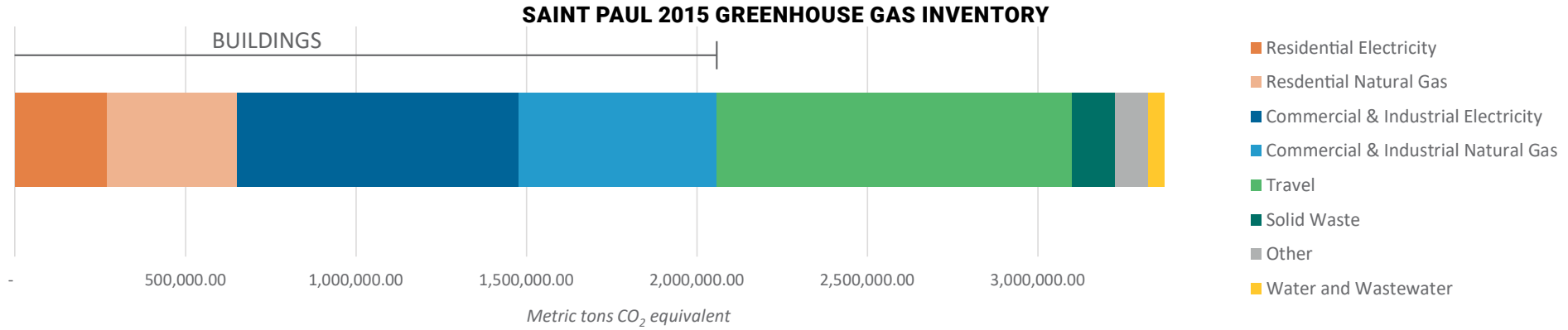
There is a call to support community resilience by helping residents prepare for, withstand, and adapt to climate-related impacts. For infrastructure, Saint Paul aims to protect and enhance natural resources and enhance it to maximize our ability to mitigate weather and climate impacts. Implementation of the plan ensures the long-term integrity to protect and enhance natural resources and reliability of built infrastructure systems by considering future climate impacts in planning. Through the **Ready and Resilient Guide**, Saint Paul partnered with Macalester College students to create a resource to prepare our community members for a variety of climate change-related events expected to occur more often and more intensely.

Mitigation

Mitigating the causes of climate change is just as important as preparing for its effects. To do so requires a change in energy resources and how energy is used; inviting both systemic and individual transformation. It is crucial to replace reliance on GHG-emitting fossil fuels with carbon-free energy sources to generate electricity, deliver heat, and power our vehicles and transportation systems. It is also critical to consume less energy through efficiency and conservation, no- and low-carbon transportation, and modified diets. Many of these behavior shifts provide natural co-benefits to people's lives. For example, walking or biking to work, especially if the commute is full of trees and greenery, has been proven to bolster creativity and decrease stress, while also reducing GHG emissions. Individuals can contribute to collective impact by living car-free, reducing air travel, deep home efficiency improvements, purchasing or installing green energy, and shifting to a more plant-based diet.

Emissions Profile

The current community emissions profile for Saint Paul includes greenhouse gas emissions across different sectors and energy sources including: residential, commercial, and industrial sources for buildings; emissions from vehicle travel; and other emissions from solid waste, water, and wastewater.



Most Saint Paul emissions in 2015 came from building energy use (61%), followed by travel (31%). Residential premises (not including multi-family) accounted for 19% of total emissions in the city, using 25% of the electricity and 46% of the community-wide natural gas. When considering residential emissions, particularly when examining the breakdown between electricity and natural gas use, it's important to consider disparities in the ability to pay for energy. For example, the city has a goal to lower the energy burden (the percent of income spent on energy costs) so that no Saint Paul household spends more than 4% of household income on energy costs; there is currently an estimated 42,124 households in Saint Paul experiencing an energy burden of 4% or above. By enabling more affordable and accessible energy options and by creating living-wage jobs in the energy sector, Saint Paul can begin to address these disparities.

Commercial and industrial premises represented 75% of the electricity and 54% of the natural gas consumption in the city, or 42% of community-wide emissions from buildings. Solid waste makes up about 4% of total emissions and does not account for emissions that occur prior to consumers' purchases of goods. Water and waste water account for about 1% of citywide emissions. The remaining emissions come from the losses in the delivery of energy and include natural gas leaks and grid loss along transmission and distribution lines.

Carbon Neutral by 2050

The City of Saint Paul has set a goal to achieve carbon neutrality by 2050. Under a business-as-usual (BAU) scenario of 1.1% annual energy growth, carbon emissions would increase 50% by the year 2050 if nothing else changed. However, Xcel Energy has committed to delivering 100% carbon-free electricity by 2050, which will decrease community-wide emissions by 28% relative to the BAU scenario. This reduction alone would get Saint Paul buildings 40% of the way toward carbon neutrality, allowing the city to focus our efforts more directly on reducing emissions from travel and natural gas. To achieve our goal of being carbon neutral by 2050, the city will need to realize an average annual emission savings of 3% across natural gas and travel emissions. Using 2015 as the baseline year, the actions in this plan along with planned emissions from electricity generation would result in a 73% reduction in emissions from a BAU scenario, or a 66% reduction from 2015 emissions.

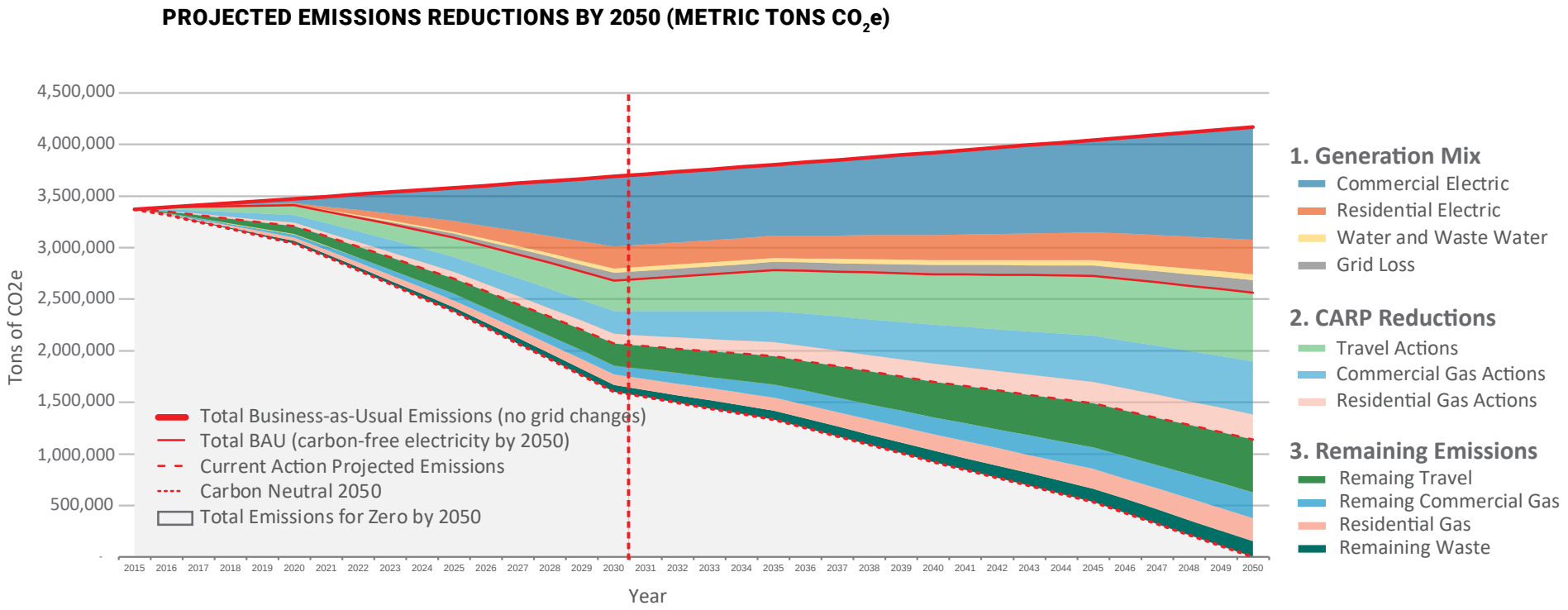


Figure 1: Projected and planned emissions reductions from Business-as-usual scenario. Data sources: Xcel Energy natural gas and electricity use (2015), Minnesota Department of Transportation vehicle miles traveled (2015)

High-Impact Actions

Some of Saint Paul's near-term strategies, highlighted in the Partners in Energy (PiE) plan, address the sectors that have a high impact on GHG emissions and can begin to be implemented in one to three years. Strategies were selected because they offered the highest likelihood of early success, laid the necessary foundational groundwork for later stage strategies, and addressed issues that needed significant lead times**.** Community-wide targets and initiatives identified in this plan and planned emission reductions from electricity generation would result in a 73% reduction GHGs from a business-as-usual scenario by 2050.

Residential (under 5 units): The highest impact actions will be 1) adopting stricter energy codes for new development, 2) retrofitting buildings with energy efficient equipment and envelope improvements, and 3) replacing natural gas appliances with electric and thermal models.

Commercial and Industrial: The highest impact actions will be 1) adopting green building standards for new buildings, 2) operating existing buildings more efficiently, and 3) retrofitting buildings with more efficient energy saving equipment.

Transportation: Transportation today has surpassed the electricity generation sector as the largest source of carbon emissions and is growing. Reducing transportation emissions is critical to achieving the goal of carbon neutrality by 2050. Transportation emissions are influenced by three main factors: 1) Land use and urban form, 2) mode of transportation, and 3) the types of fuels that are used.

Waste and Water: The City of Saint Paul, through Resolution 14-519, established goals of diverting 40% of waste from landfills by 2020 and 80% by 2030. Water priorities emphasize preservation of safe, quality drinking water and promotion of a culture of water conservation and stewardship.

Photo Credit: Kurt Schultz, Mural Artist: Kalaka, East 7th Street and Arcade Street

Photo Credit: Great Plains Institute

While climate change poses many challenges, it also presents great opportunity to create a more livable and equitable city. In Saint Paul, 36% of households spend more than 4% of their income on home energy costs. Low-income residents and residents of color are more likely to live in neighborhoods without sufficient natural amenities like an adequate tree canopy. Streets in these neighborhoods, in some cases, have poor walkability and bike infrastructure and/or lack access to quality transit. Many climate solutions are also equity solutions. As the city looks to reduce our greenhouse gas emissions, we will need to reduce energy consumption in homes and commercial spaces, create a workforce to respond to the challenges, provide multiple options for mobility, and strengthen our urban forest. Where and how these solutions are implemented matters. Creating a more equitable Saint Paul is key to the success of this plan.

The effects of climate change are apparent in Saint Paul and have a disproportionate impact on low-income communities, especially low-income communities of color. This plan identifies not only strategies to decrease emissions, but also strategies to mitigate negative impacts of climate change so that all community members, present and future, can experience a high quality of life. Leveraging city leadership, experts, community members, and advocates, this plan lays out a path toward resilience. To achieve carbon neutrality by 2050, Saint Paul needs to assess how it can have the greatest impact on its contribution to climate change. Vulnerabilities to a changing climate vary across built and natural infrastructure and populations. This plan provides strategies for Saint Paul to address these vulnerabilities.

Community Involvement

During the development process for this Climate Action and Resilience Plan, the city created multiple opportunities to listen to community voices and perspectives on this document and its content. Five in-person public forums were held across the city during Spring 2019. The meetings were held largely in partnership with regularly scheduled events, and emphasis was placed on pursuing meeting spaces where diverse resident voices would be heard and engaged. The meetings were held across the community, in Frogtown, West Side, Payne-Phalen, Dayton's Bluff, and Mac-Groveland neighborhoods. Across all five meetings, the city was able to interact with, and gather input from, a total of 175 community members.

City of Saint Paul staff developed an interactive game to help community members engage with and prioritize strategies for individual sector emissions reductions goals during the engagement sessions. The game provided a relative emissions impact for different strategies, as well as a proportional cost associated with implementation. Participants were encouraged to discuss the benefits and risks associated with different strategies and provide a consensus-driven ranking of the strategies. This was also an opportunity for meeting attendees to suggest or discuss additional strategies for inclusion in the Plan.

Photo Credit: City of Saint Paul

In addition to in-person meetings the city also hosted an online feedback portal where interested parties could submit longer, narrative comments. The portal was open for a three-month period, over the course of which the city received 53 comments. The city also held focused stakeholder and advocate meetings to discuss certain components of the plan like equity and workforce development. The results of these meetings and conversations are incorporated throughout the Plan.

The city recognizes that this Climate Action and Resilience Plan is a living document; just as it was shaped by community input, it needs to continue to evolve as Saint Paul grows and the needs of its citizens change in response to a changing climate. A desire to stay informed on implementation and progress on climate action was frequently heard through the public comment period. To ensure that the Plan maintains its relevance and applicability, the city should continue to engage the community.

Photo Credit: Great Plains Institute, Mural Artist: Sara K. Udvig, Margaret Park

Vision for 2050

As a capital city with a thriving economy, Saint Paul is a leader in cross-sector approaches to emissions reduction, adaptation, and resilience and a model for both urban and rural communities in Minnesota. Our air, water, and urban landscape are clean and safe. Uncertainty is viewed as an opportunity, challenging us to innovate with changing technology to adapt to continued advances in shared-mobility, energy efficiency, and renewable energy. All residents have a manageable energy burden.

As a carbon-neutral and zero-waste city, electric vehicles are commonplace now that the infrastructure to support them is standard. Walkable, bike-friendly neighborhoods with easy access to transit that accommodates all work schedules means fewer trips by car.

Slowed growth in the movement of goods by truck, train, barge, and people by plane help reduce overall emissions. These choices and our robust social connections make all of Saint Paul's neighborhoods strong and resilient.

By preserving, growing, and diversifying our urban canopy and ground cover on both public and private land and cultivating urban agriculture we continue to prepare for, and adapt to, the effects of climate change. Neighborhood parks and trails help make Saint Paul a healthy and safe place for all.

Politically engaged residents empowered to make decisions help sustain long-term involvement. Our youth benefit from a strong network of educational resources, learning opportunities, and are engaged in every aspect of decision-making. A clear focus on innovation, workforce participation, and opportunities for all students in green jobs of the present and future ensure access to green workforce training at the post-secondary level. Environmental stewardship is a hallmark of Saint Paul's climate action and adaptation efforts.

To track our progress and keep up on the latest innovations, technologies, and best practices it will be essential for Saint Paul to update this Plan every five years.

Photo Credit: Great Plains Institute, Mural Artist: Sara K. Udvig, Margaret Park

Photo Credit: Great Plains Institute

Saint Paul as a Leader and Model

While Saint Paul's government buildings and operations account for a small percentage of the city's total greenhouse gas emissions (about two percent) the city has taken, and will continue to take steps, to reduce our own emissions. In this way, Saint Paul leads by example, encouraging our business, industrial, institutional, educational, and residential communities to implement aggressive strategies of their own.

City government cannot do it all. More needs to be done by people and organizations. This Plan identifies strategies for the buildings, transportation, and waste sectors that are designed to enhance and maximize emissions reduction efforts citywide. Not only will these efforts result in improved environmental quality and health of Saint Paul residents and visitors, many of them have the added benefit of saving money on energy costs for residents, businesses, and institutions.

Saint Paul has already made great strides toward greater environmental sustainability and increased climate resilience. In 2015, the city signed on with the Compact of Mayors, which requires the city to complete a GHG inventory, set GHG targets, and develop a climate action and resilience plan. The city has been actively working to meet these commitments. Between 2009 and 2016, the city implemented 476 energy efficiency projects, which have saved $1.3 million. Other initiatives launched by the city include:

- **Energy Smart Homes and Inspiring Communities**
- **Sustainable Building Policy**
- **Deployment of Electric Vehicle Charging Infrastructure**
- **Step 5 achievement in the Minnesota GreenStep Cities Program**

In 2018, the city was awarded funding under the **American Cities Climate Challenge** to accelerate actions to meet our climate goals. With the support of this program, the city will more aggressively tackle emissions from city operations, develop a network of charging hubs throughout the city that will support electric car-share and public charging, and implement building energy benchmarking program, among other ambitious projects. Saint Paul is well on our way to curbing GHG emissions through innovative practices. The development of this plan will solidify and guide further action toward carbon neutrality and a more resilient city by 2050.

WHAT CAUSES CLIMATE CHANGE?

Since the Industrial Revolution, humans have used fossil fuels (coal, oil, and natural gas) as the energy inputs for travel, space heating, electricity, and industrial processes. The acts of extracting and burning these fuels result in the release of greenhouse gases (GHGs), predominantly carbon dioxide (CO_2). These gases rise into the atmosphere where they can stay for thousands of years, trapping heat as it bounces off the earth's surface — agricultural practices and deforestation are also major emitters of CO_2. As more GHGs accumulate in the atmosphere, more heat is trapped. Over the past 260 years, enough GHGs have been released into the atmosphere that they have led to an increasing global average temperature. Increasing temperatures have been changing the climate worldwide and, if left unchecked, threaten to dramatically disrupt our current way of life, locally and globally.

Greenhouse gases are released through human activity

These are the most common sources of emissions that are generated within or due to activity in cities:

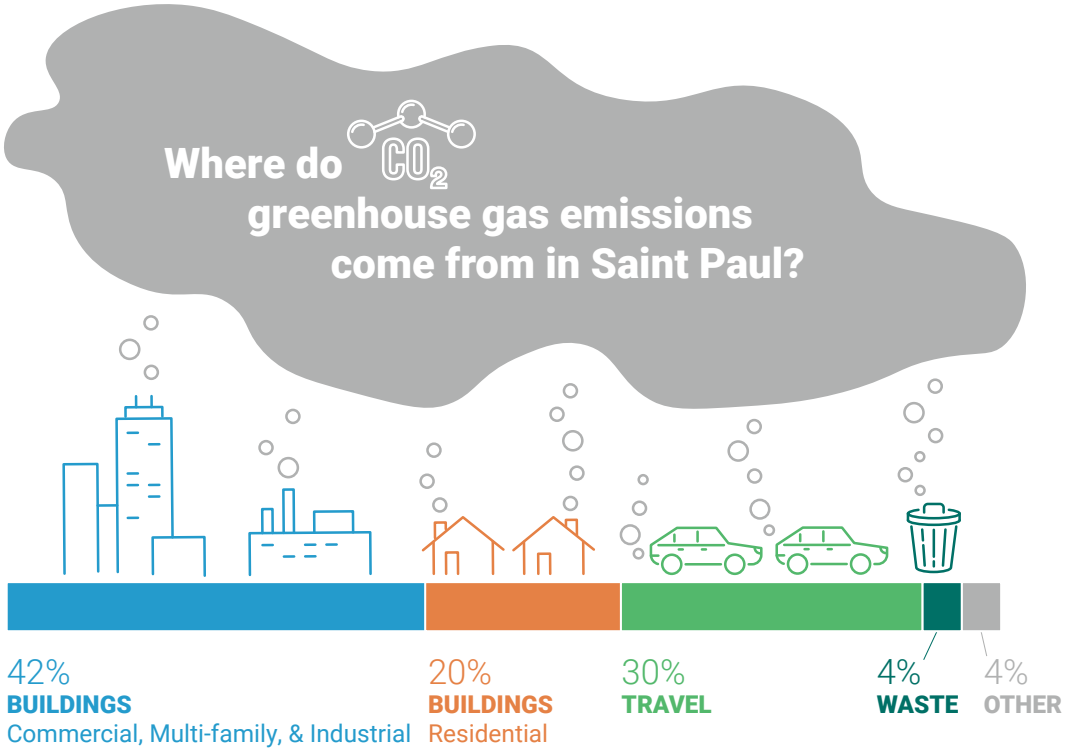
Generation of electricity (i.e., coal or gas-fired power plants), which is used in homes, businesses, industry, outdoor lighting, and increasingly for transportation.

Space and water heating that use natural gas, propane, heating fuel, or electricity generated from the combustion of fossil fuels.

Industrial and manufacturing processes that use natural gas or generate CO_2 during production.

Modes of transportation that combust fuel (e.g., gasoline, diesel) to run. This includes most cars, trucks, freight, planes, boats, off-road vehicles, and more.

Generation and disposal of waste results in GHGs that are released during the production of goods and after goods are disposed of — from methane released at landfills or GHGs emitted from waste-to-energy plants.



Take a closer look at Saint Paul's Community Emissions Profile on page 30

LOCAL IMPACTS OF A CHANGING CLIMATE

The Report from the Interagency Climate Adaptation Team prepared by the Minnesota Pollution Control Agency identifies warmer summers and winters and more frequent and intense weather events as the hallmarks of climate change in Saint Paul, which can impact health, livability, landscape, and the environment. The report states that the frequency and severity of extreme cold conditions are declining rapidly, adding that the heaviest snow storms have also become larger even as winter has warmed. Heavy downpours in Minnesota are now twice as frequent as they were a hundred years ago, and scientists expect events like these to become an increasingly common part of our daily lives.

Saint Paul will become warmer and wetter as a consequence of climate change. We know that warmer temperatures are often accompanied by increased humidity, increasing the heat index and making the air feel hotter. Extreme heat events are increasing in Minnesota and can cause a variety of heat-related illnesses like heat stress and heat stroke.

In April of 2016, Saint Paul-Ramsey County Public Health developed a **climate change vulnerability assessment**, which identified populations and geographic areas that may be particularly vulnerable to climate hazards. The climate hazards likely to impact Saint Paul are:

Extreme Heat Events: Heatwaves are expected to become more common by the middle of the 21st century. Extreme heat will be exacerbated in urban areas where impervious pavement and limited vegetation result in the urban heat island effect.

Poor Air Quality: Air pollutants, such as ozone, particulate matter, and allergens pose acute and chronic respiratory and cardiovascular threats. Rising temperatures and changes in precipitation patterns may lead to increased air pollution. Increased frequency of wildfires in the western United States and Canada have also impacted local air quality.

Changes in Precipitation: Increased precipitation has already been observed in Minnesota and is likely to increase into the future. This increase occurs in all seasons, but spring and summer are becoming wetter at a faster rate than fall and winter. Changes in precipitation patterns will likely lead to more river and flash flooding.

Ecological Changes: Vector-borne disease transmission is expected to increase due to changes in the distributions of ticks, mosquitoes, and other insect vectors as a result of warming temperatures and changing precipitation patterns. Diseases include West Nile Virus, Lyme disease, and human anaplasmosis. The urban forest is directly impacted by invasive species like Emerald Ash Borer, that can lead to changes in the canopy and reduce the benefits that a healthy forest provides.

Psychological Impacts: Climate change can lead to negative mental health outcomes caused by the acute trauma of an extreme weather event or the gradual onset of climate change. Mental health issues may include anxiety, stress, depression, and post-traumatic stress disorder (PTSD).

CLIMATE RESILIENCE

The City of Saint Paul developed a **Strategic Framework for Community Resilience**, which includes strategies to incorporate climate change adaptation into relevant local and regional plans and projects. The purpose of this framework is to ensure that climate resilience strategies are integrated into emergency management and community planning documents and increase the community's adaptive capacity while promoting a healthy and prosperous community. The framework identified the acute shocks and chronic stressors that were most likely to have an impact on life in Saint Paul.

Acute shocks include sudden, intense events that threaten a sector and examples include floods, heat waves, infrastructure failures, and disease outbreaks. Chronic stressors are ongoing conditions that weaken the fabric of a city on a day-to-day or cyclical basis. This can include unemployment, aging infrastructure, or an overtaxed public transportation system. The graphic to the right summarizes the top shocks and stressors identified by volunteer stakeholders who participated in the development of the framework.

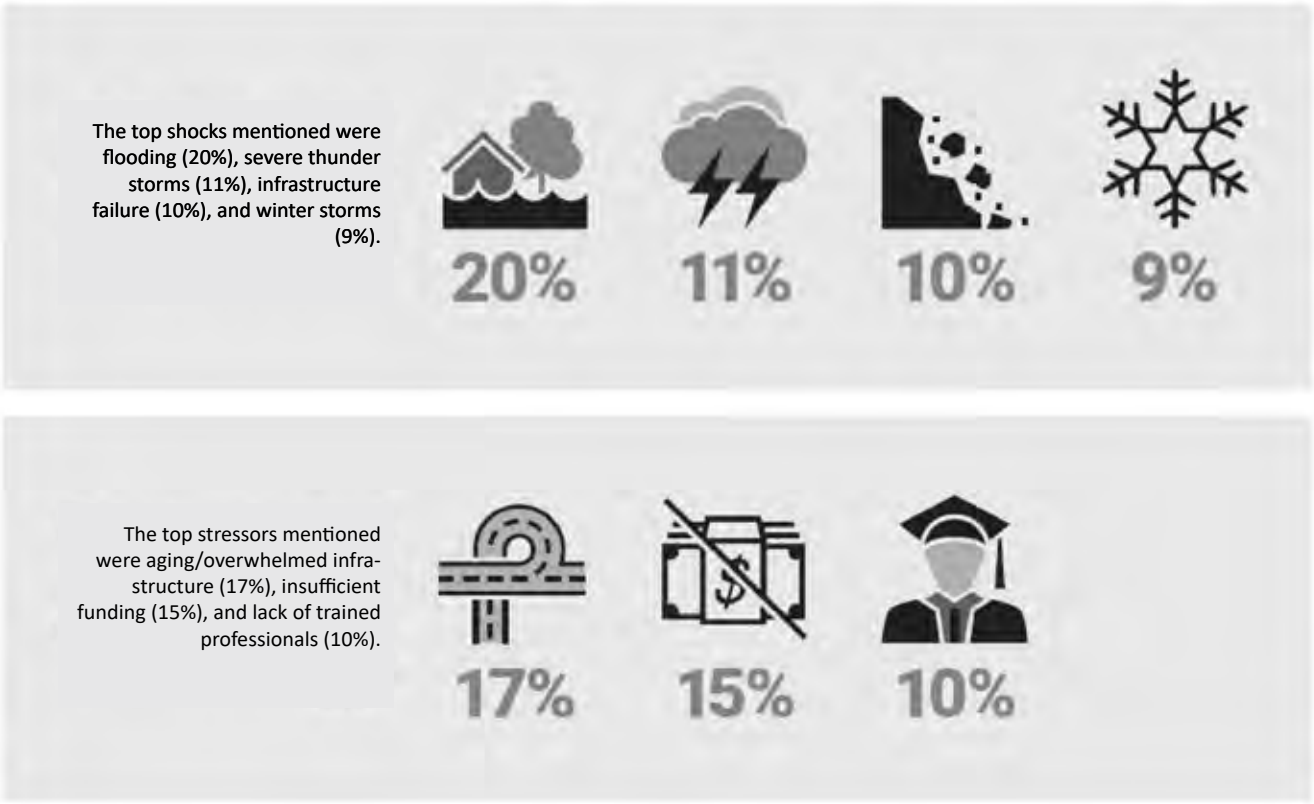


Figure 2: Strategic Framework and Community Resilience

The 2040 Comprehensive Plan reinforces the importance of climate resilience. Policies in the plan direct the city to incorporate climate resiliency into Parks and Recreation design and programming, increase the use of green infrastructure to mitigate flooding, and to apply an equity lens to all resilience projects.

For a community to improve its resilience, it must know what its vulnerabilities are. Certain populations, infrastructure, and natural assets can be more vulnerable to shocks and stressors depending on different factors including social determinants, condition, and environment. The following pages identify the climate vulnerabilities that occur in Saint Paul.

CLIMATE VULNERABILITIES

Climate change has the potential to have major impacts on people, the economy, and infrastructure — both built and natural. Climate hazards can lead to disruption in people's lives and threaten health and quality of life. Assets like buildings, bridges, and roads are directly threatened by increased frequency and intensity of rain events, freeze/thaw cycles, and extreme weather events. Power outages due to storms or sustained heat waves may increase in frequency and duration impacting local economies and health.

According to Ramsey County Public Health, vulnerability refers to the characteristics and situation of a person or group that negatively affects their ability to anticipate, adapt to, and recover from the effects of a climate hazard. Built infrastructure like roads, bridges, and sewers can also be vulnerable to climate change depending on their condition and if they were not constructed to be resilient to anticipated changes. Similarly, natural infrastructure, such as trees and bodies of water, can also be susceptible to climate hazards, potentially increasing the risk to populations and property.

Climate hazards that are likely to have a local impact over time were highlighted above. This section identifies vulnerabilities across populations, natural infrastructure, and built infrastructure – a complete vulnerability assessment prepared by Saint Paul Ramsey County Health **can be found here**.

Vulnerable Populations

Population vulnerability can be situational, meaning an individual may only be vulnerable in the wake of a climate hazard, not necessarily inherently vulnerable. It can be temporary and dynamic, such as with the case of pregnancy, illness or homelessness. Examples of population vulnerabilities are low socioeconomic status, limited education, pre-existing physical or mental health illnesses, barriers in communication especially for non-English speakers, and being very old or very young.

The growing disparities among various populations in Saint Paul demands greater attention on minimizing climate-related impacts on at-risk groups. For instance, as Saint Paul continues to experience increasing numbers of days with high temperatures, air conditioning in the summer is going to become as essential to the livability of a house or an apartment as is heat in the winter. More affluent residents likely will have the resources and access to climate change resilient solutions. Low-income residents may not have access to, or be able to afford air conditioning (both units and electricity to run an air conditioner), during times of extended extreme heat and will need assistance.

Understanding the needs of residents and meeting people where they are will help the city better know where to direct resources. This is important both to help prepare vulnerable residents for climate hazards and to provide support in the aftermath of a major event.

The following looks at the social and financial determinants of Saint Paul's population vulnerability. These include age, race, language, income, housing, ability, access to a vehicle, and respiratory illness. Residents who live at the intersection of two or more of these determinants are among the city's most vulnerable and it is critical for the city to prioritize improving the resilience of our most vulnerable. Demographic data comes from the 2013-2017 American Community Survey 5-year estimates.

AGE OF RESIDENTS

In terms of age, residents under the age of 5 (7.6% of population) and over the age of 65 (9.8% of population) tend to be most vulnerable to many climate hazards. For instance, these groups may be more susceptible to poor air quality, hot summer days, and any event that might impede mobility, such as severe weather, like damaging winds or flash flooding.

RACE AND LANGUAGE

Between 2000 and 2015, the percentage of people of color living in Saint Paul grew from 35% to 46%. The city, and the Twin Cities metro region, have seen growing racial disparities in terms of employment, income, housing cost burden, education, and homeownership. As a result, low-income, people of color tend to live in neighborhoods where they may be more vulnerable to climate hazards. There are 126 languages and dialects spoken in Saint Paul Public Schools; the most frequently spoken languages after English are Hmong, Somali, and Spanish. For many of these community members, informational materials in English may not be helpful. Health and safety warnings, and other outreach efforts may not reach these communities, creating additional risk in climate change-related events.

INCOME AND HOUSING

As of 2017, the median household income for Saint Paul was $52,841, with 9.9% of residents living below the poverty threshold. According to the 2018 Minnesota Homeless study by Wilder Research, 1,927 people experience homelessness in Ramsey County including those who live in emergency shelters or transitional housing; this is up from 1,787 in 2015. Low-income residents and those with unstable housing are more vulnerable to, and may be less likely to recover from extreme weather events that cause property damage.

ABILITY

Like age and other social indicators, an individual's ability level may impact how well they are able to adapt to a changing climate. As of 2017, 11.6% of Saint Paul community members identified as living with or experiencing some type of disability, which might include ambulatory limitations, hearing or vision loss, or cognitive difficulty.

ACCESS TO VEHICLE

As of 2017, 14% of Saint Paul community members did not have access to a vehicle. 88% of residents without access to a vehicle were renters. In a city that supports equity and car-free lifestyles, there will need to be consideration for how to move people without access to personal vehicles in times of emergency.

RESPIRATORY ILLNESS

In Ramsey County, there were 9,339 asthma-related emergency room visits, and 1,202 asthma-related hospitalizations between 2013 and 2015. 12.5% of these hospitalizations were experienced by individuals over the age of 65, while 23.7% were experienced by individuals under the age of 18. Those living in poverty represented 16.5% of hospitalizations (Source: MDH asthma query data, 2013 – 2015). There are disproportionately higher rates of asthma-related hospitalizations along the I-94 corridor, in downtown Saint Paul, and in eastern Saint Paul (Saint Paul-Ramsey County CCVA, 2016).

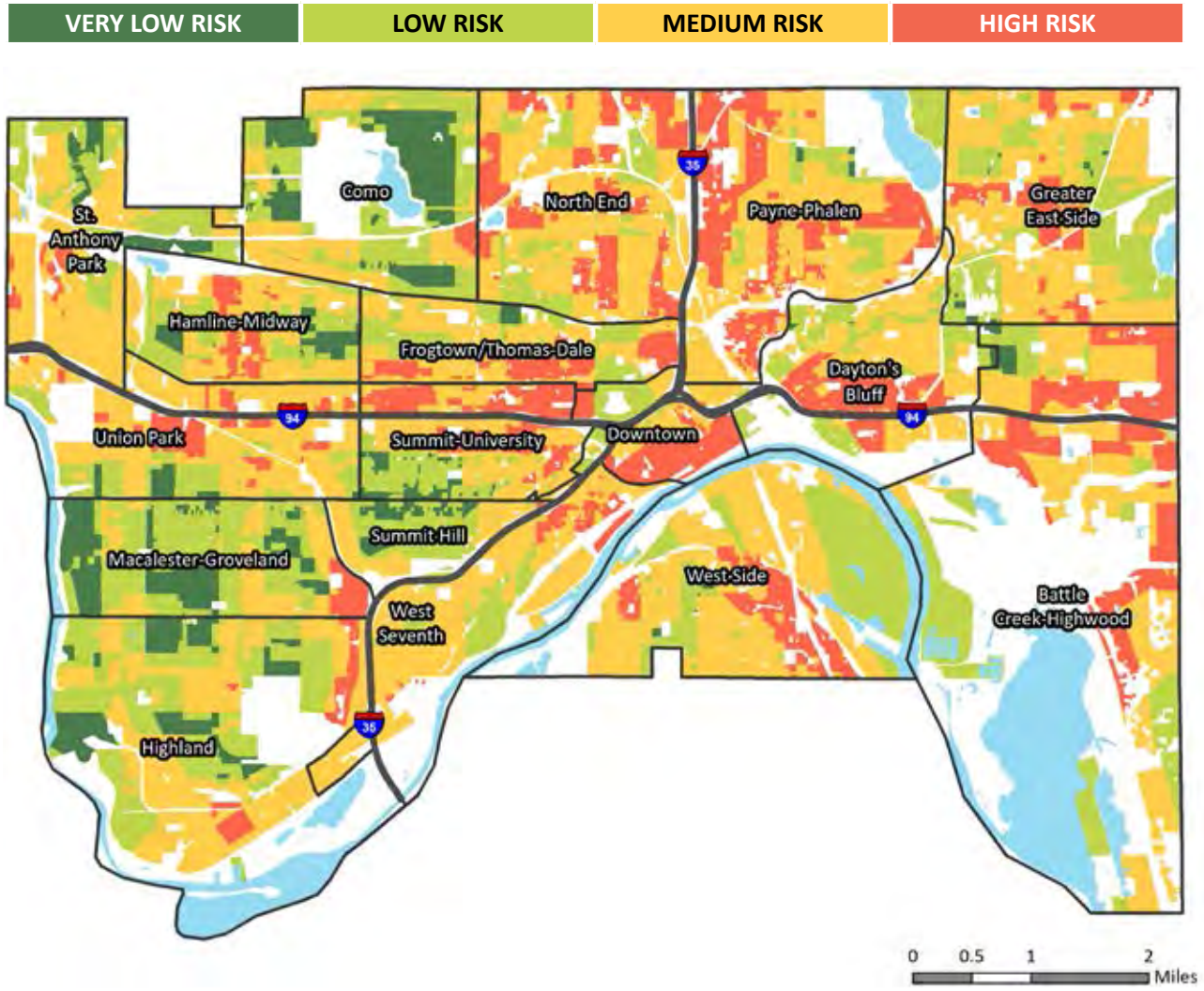
	HAZARD	VULNERABLE POPULATIONS	IMPACTS
	**Heavy Rain Events**	• Older adults, especially those living alone and/or have low-incomes • Residents with limited English proficiency • Residents with mobility limitations (access to transportation, ambulatory difficulties) • Residents who lack property, rental, or homeowner insurance (typically low-income)	• Drowning or injury • Mold or waterborne disease • Economic loss • Property damage • Travel limitations
	**Extreme Weather Events**	• Older adults, especially those living along and/or have low-incomes • Residents with limited English proficiency • Residents with mobility limitations (access to transportation, ambulatory difficulties) • Residents who lack property, rental, or homeowner insurance (typically low-income) • Homeless and those in unstable housing	• Property damage • Injury or death • Travel limitations
	**Poor Air Quality Days**	• Older adults, especially those living along and/or have low-incomes • Younger children • Residents with respiratory illnesses • Those who work outside • Residents living near high-volume traffic corridors (interstates, arterial roads)	• Asthma attacks • Severe allergies • Cardiovascular health
	**Extreme Heat**	• Older adults, especially those living along and/or have low-incomes • Younger children • Residents with respiratory illnesses • Those who work outside • Low-income residents with no or limited access to air conditioning • Homeless and those in unstable housing	• Heat stress • Heat stroke • Cardiovascular health • Dehydration

Vulnerability by Location

Exposure to different types of climate risks varies depending on where someone lives within the city. Air quality, extreme heat, risk of flooding, and composite vulnerability are not experienced the same way across the city. Using the Saint Paul-Ramsey County Health Climate Vulnerability Assessment, the following section uses maps to demonstrate how vulnerability to these events vary by location. A full list of the factors included in this assessment and how Ramsey County evaluated risk can be found in Appendix C.

AIR QUALITY

Air quality refers to the concentration of particulate matter in the air, which impacts individuals' health. Exposure to poor air quality can lead to an increased risk or severity of asthma, other respiratory illnesses, and can result in elevated risk of heart disease and stroke. Children and older community members, as well as those with pre-existing conditions, are more sensitive to poor air quality. Other factors, like proximity to highways or industrial uses can increase health risks. Areas with dense vegetation can help improve local air quality as vegetation, like trees, naturally filter air. In a changing climate, we can expect to see more days on average with higher concentrations of air pollutants. Per the map at right, the greatest risk of exposure to poor air quality in Saint Paul is along roads and highways where there are high volumes of vehicles. This includes the I-94 corridor through the city, as well as along highway 35E.

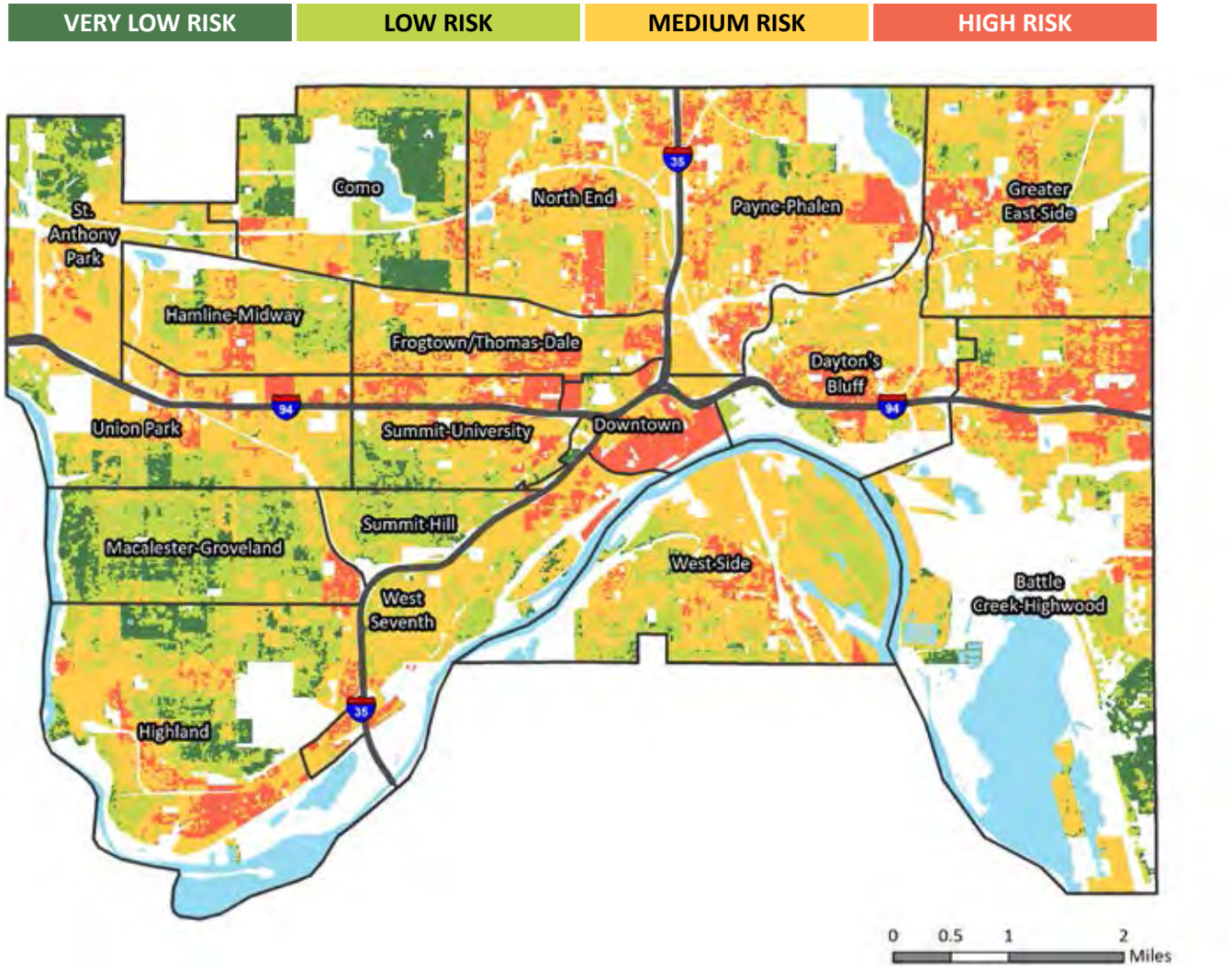


Map 1. Identifies the relative risk exposure to poor air quality (very low, low, medium, and high risk) across the city of Saint Paul. This analysis was originally conducted by Saint-Paul Ramsey County Public Health through its Climate Change Vulnerability Assessment in 2016.

EXTREME HEAT

Urban heat island effect is caused by dark surfaces (e.g., rooftops and asphalt) absorbing the sun's heat and slowly releasing it through the night. This results in higher overnight temperatures in low-vegetation urban areas relative to surrounding communities. Many people face an increased risk of heat stroke and heat exhaustion and can be particularly vulnerable during extended heatwaves. The map at right shows how the risk of experiencing extreme heat varies relatively across Saint Paul.

The greatest risk of exposure to extreme heat is prevalent in areas across the city with less dense vegetation and tree canopy cover – namely, portions of downtown Saint Paul, Frogtown, Greater East Side, and Dayton's Bluff neighborhoods, where prevalent high risk exposure exists. There is also high risk on the southern edge of Highland Park neighborhood.



Map 2. Identifies the relative risk of exposure to extreme heat (very low, low, medium, and high risk) across the city of Saint Paul. This analysis was originally conducted by Saint-Paul Ramsey County through its Climate Change Vulnerability Assessment in 2016.

FLOODING

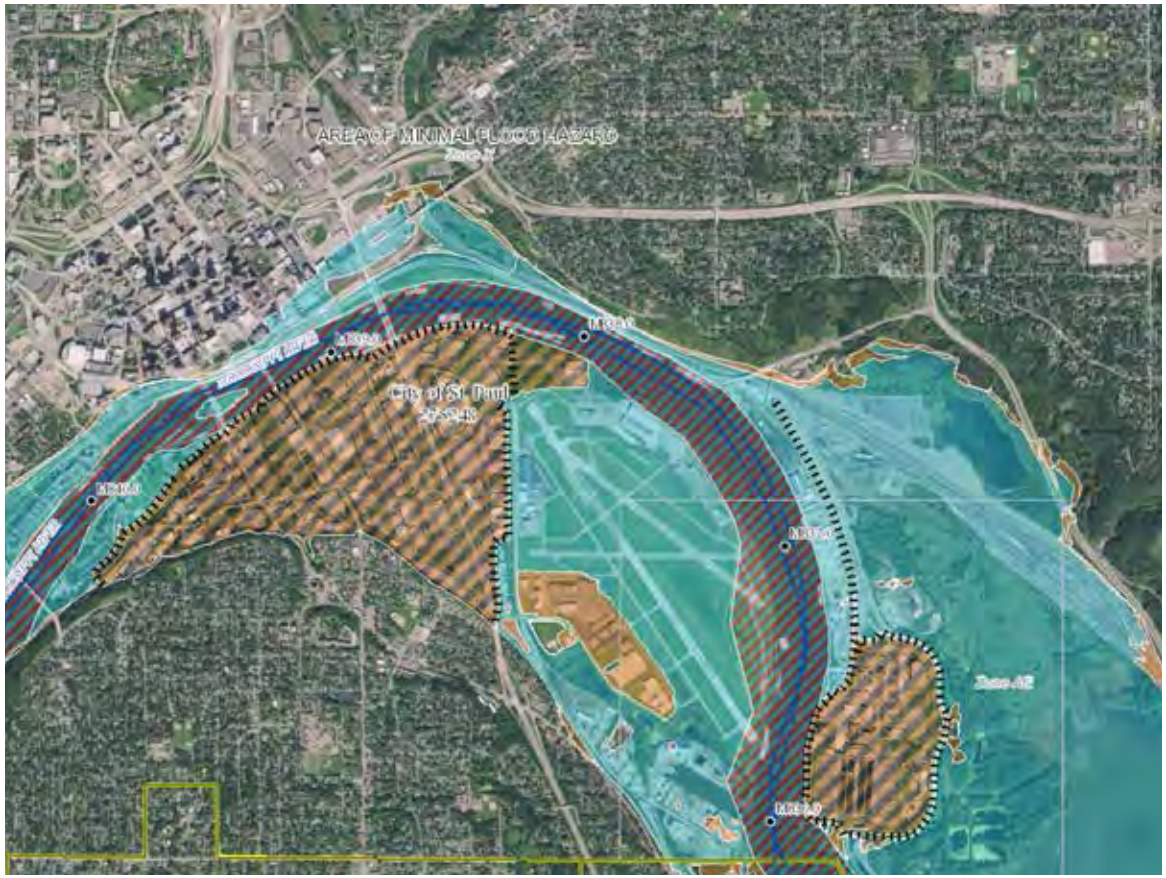
Risk of flash flooding also varies across Saint Paul and is influenced by topography, watershed, and land use. Areas that are more susceptible to flash flooding tend to be low-lying with high levels of impervious surfaces, like roads and parking lots. Areas with greater biomass and vegetation coverage, as well as higher elevation, are at a relatively lower risk.

Flooding can happen quickly or gradually, due to heavy precipitation in a short period of time, frequent precipitation during a period of high soil saturation, or disruption to freeze and thaw cycles that accelerate snow melt.

The city has already experienced an increase in the occurrence of heavy flood events, exceeding Major Flood Stage. Three of the top ten historic flood events have occurred in the last decade (2011, 2014, 2019). Eight of the last ten major flood events have required city action for response and recovery efforts.

Saint Paul faces risks and vulnerabilities associated these heavy precipitation events that will continue to increase in frequency and duration as the climate changes. The city has conducted modeling on historic flooding events and continues to monitor the risk of flooding by evaluating and understanding infrastructure.

Based on this analysis, Saint Paul's highest risk areas for flooding are those near the river, particularly in the FEMA designated floodplain which includes areas like Lowertown, Childs Road, Barge Channel Road, and Harriet Island. Outside of these areas, risk of flooding in Saint Paul is largely dependent on circumstances. To better prepare for and respond to flooding in the Lowertown area, the city is exploring options to better protect properties in this area through various flood mitigation techniques.

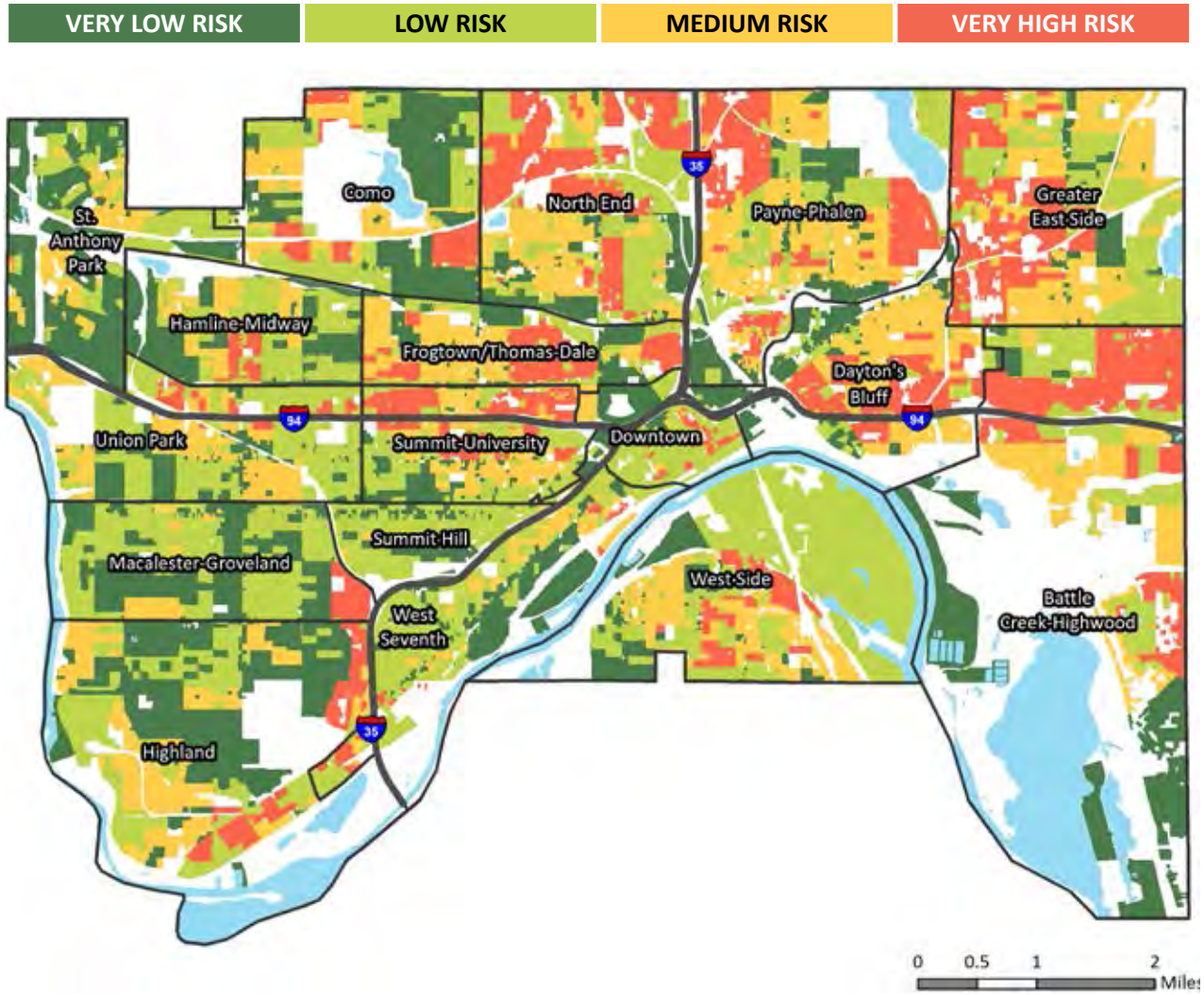


Map 3. The Federal Emergency Management Agency (FEMA) official maps show Special Flood Hazard Areas (SFHA) and the risk premium zones applicable to a community. The majority of Saint Paul is designated as at minimal risk of flooding hazard by FEMA. Areas near the river are at the highest risk of flooding. Data from FEMA, 2018.

COMPOSITE VULNERABILITY

The composite vulnerability map at right broadly displays areas of Saint Paul where residents are most at risk to climate-related hazards.

Areas in the Frogtown/Thomas-Dale, North End, northern Payne-Phalen, and Greater East Side neighborhoods are identified as having the highest combined risk of negative impacts resulting from climate change. These areas are largely concentrated in the northeastern and north central portions of the city. In contrast, the western portion of the city is at comparatively low risk.



Map 4. Characterizes the composite vulnerability based on the relative risk of exposure to poor air quality, extreme heat, and flooding (very low, low, medium, and high risk), as well as demographic inputs, across the City of Saint Paul. This analysis was originally conducted by Saint Paul-Ramsey County Public Health through its Climate Change Vulnerability Assessment in 2016.

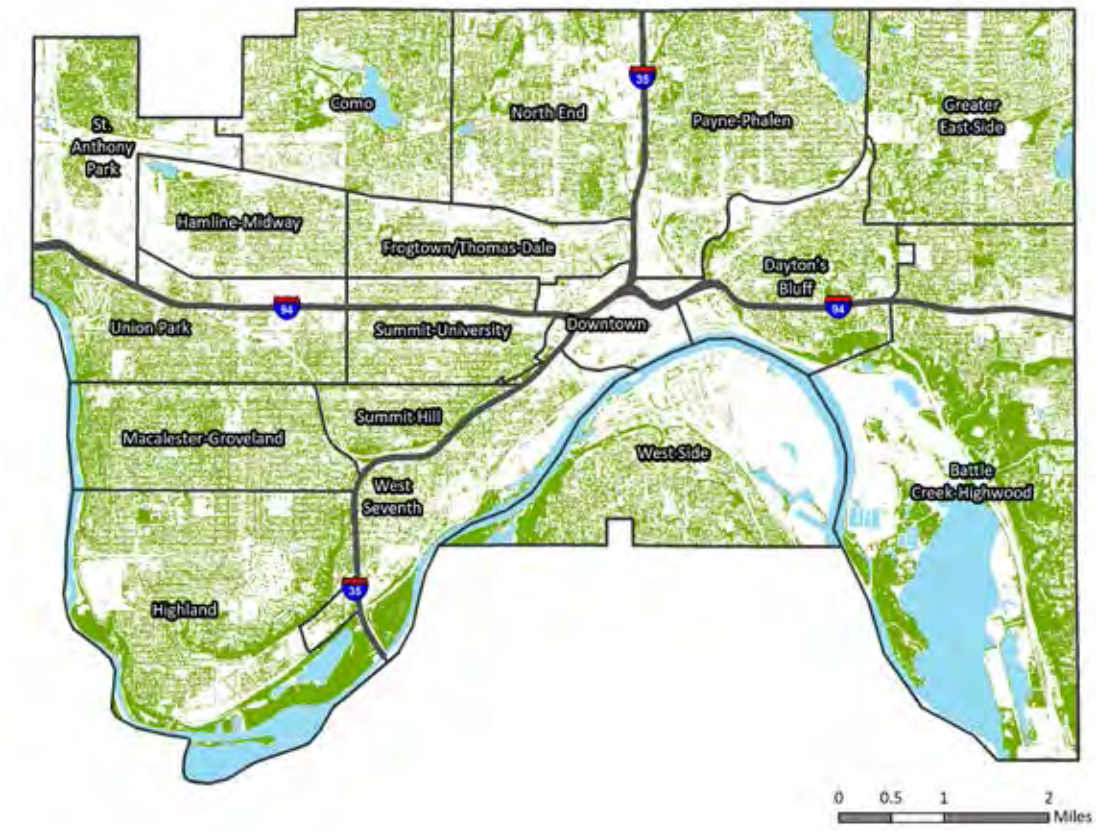
Natural Infrastructure

Natural infrastructure includes ecological systems that perform environmental services like stormwater management and air purification, as well as enhance the livability and aesthetics of a place. Environmental assets like trees, native plants, surface and groundwater, and beneficial species improve the resilience of the city and are susceptible to climate change. Urban forests provide a multitude of benefits including reducing the urban heat island effect, supporting stormwater management, and acting as a carbon sink (absorbing carbon dioxide from the atmosphere), among other benefits.

URBAN FOREST

Saint Paul has a rich landscape that benefits our residents, businesses, and visitors. Preserving and growing this asset of trees and green space is important to the health and vitality of Saint Paul. Trees are the lungs of the city; they purify the air, and store carbon, reducing the greenhouse effect. Trees protect the soil from erosion, reduce urban heat island effect, provide wildlife habitat, and help manage stormwater, which can prevent or reduce flooding.

In 2011, the citywide canopy cover was found to be 32.5%; though this figure was calculated prior to Emerald Ash Borer. Residential areas with high private tree canopy cover, as well as parks and green space, have the highest proportion of canopy cover. Downtown Saint Paul, with its dense development and high percentage of impervious surface, has the lowest canopy cover. The canopy cover of most Saint Paul neighborhoods is close to the city average. However, neighborhoods with a lower canopy cover are located along University Avenue, West Seventh Street, and Saint Paul's West Side. Areas with low canopy cover often correspond to areas in the city with increased transportation infrastructure (including freight rail) or land uses that have historically been industrial or commercial. See the extent of Saint Paul's urban canopy in the map (City of Saint Paul Urban Canopy Assessment 2011).



Map 5. Overview of total canopy cover in the City of Saint Paul by ward. Last updated 1/9/2019 by the Saint Paul Forestry Unit.

The urban forest is vulnerable to invasive species, like Emerald Ash Borer (EAB), as well as extreme weather events with heavy rain and strong winds that, in combination with factors like root cutting for construction and saturated soils, can result in uprooting established trees. A healthy, well maintained tree planted in a space with suitable capacity for the root system is much more likely to withstand heavy rains and strong winds. Drought may also impact the health of the urban forest. For example, trees that require more water in the hotter months will need additional water and maintenance. Drought stress can also lead to negative impacts by both native and non-native insect damage, exacerbating all stress factors (Saint Paul Urban Forestry Plan, 2011; Plants for the Future, 2018).

As of January 2019, nearly 129,000 total trees have been inventoried in the City of Saint Paul, representing approximately 59 different types. In addition to the physical factors associated with a changing climate, Emerald Ash Borer (EAB) is currently a biological threat to the city's ash trees. Many cities from the East to the Midwest have lost large portions of their ash trees due to EAB. Saint Paul has four different species of ash, which comprise 13.7% of the total tree count on city property. Map 6 provides a visualization of the location of ash trees in public rights-of-way, which may give some insight into the impact that Emerald Ash Borer could have on the city's overall tree canopy. While ash trees are distributed throughout the city, there are areas of higher ash tree density in the Summit-University, Payne-Phalen, and the Greater Eastside neighborhoods. As ash trees are removed, the tree canopy in these communities will be noticeably altered for decades as replacement trees take time to mature.

Map 6. Locations of individual ash trees across Saint Paul. Last updated 1/9/2019 by the Saint Paul Forestry Unit.

WATER QUALITY AND AVAILABILITY

The Mississippi River is the main source for Saint Paul's drinking water. While the river is a stable source of freshwater, its greatest risk comes from contamination. Rainwater travelling across pavement during heavy rainfalls can pick up trash, leaves, animal waste, salt, and chemicals. If these items reach the river through storm drains, they can pollute the water. Keeping rainwater where it falls, or slowing its path to lakes and rivers, helps reduce the load on storm sewer capacity and gives nature a chance to filter out harmful chemicals and other pollutants.

Photo Credit: Great Plains Institute

Built Infrastructure

Built infrastructure includes roads, bridges, water mains, sewer lines, energy distribution, streetlight networks, buildings, and other critical infrastructure. Impacts of a changing climate can be seen in damage to buildings during extreme weather events as well as impacts to infrastructure including erosion, landslides, buckling of roads, and damage to bridges.

ROADS AND BRIDGES

Flash floods and extreme precipitation can have damaging impacts to road and bridge infrastructure, compromising the integrity of the engineering and making it unsafe for community members. Water and debris scour bridges, leaving them vulnerable to damage and failure during flooding by undermining bridge foundations or removing the protection from the abutment slopes. Additionally, extreme heat can cause roads to buckle and damage other transportation infrastructure such as rail lines. This may increase expenditures for repairs and maintenance, as well as create dangerous conditions for drivers, potentially disrupting travel (MPCA Adapting to Climate Change in Minnesota, 2017).

WATER DISTRIBUTION, STORMWATER, AND WASTEWATER

Increased frequency and intensity of precipitation and flood events will have consequences and put additional pressure on the city's water distribution and drainage infrastructure. Changes in amount, frequency, and intensity of precipitation impact stormwater management, potentially exceeding the design capacity of stormwater treatment structures or impacting future structure design. For example, changing freeze and thaw cycles puts pressures on potable water mains, as shifting soils can cause pipes to break. The city's sewer collection system may be vulnerable as well due to age - 72% of the system is older than 50 years (Infrastructure Stress Transparency Tool).

ENERGY DISTRIBUTION INFRASTRUCTURE

Energy reliability is a major concern for utilities and members of the community. Any event impacting the distribution system that leads to power failure must be addressed as quickly as possible. Extreme weather events and ice storms pose threats to distribution infrastructure and could lead to power outages. This is especially critical in times of extreme temperatures when people have heating and cooling needs; it also impacts those who depend on medical devices that rely on electricity. Building a resilient grid by burying power lines where feasible, incorporating micro-grids, and having back-up power, can help to minimize risk.

CRITICAL INFRASTRUCTURE

Critical infrastructure can include hospitals, schools, emergency services, and community centers. Critical infrastructure is highly vulnerable to electric outages, which can increase in frequency with heavy precipitation or extreme heat. Damage to critical infrastructure can disrupt emergency response and impact the health of those in need of emergency services.

People

Support community resilience among residents to prepare for, withstand, and adapt to climate-related impacts.

ECONOMIC AND SOCIAL WELL-BEING

- Strengthen social connectedness through relationship-building among community members across age, ethnicity, income, and other demographic differences
- Create an environmental justice advisory committee to advise the city on equitable resilience actions
- Encourage equitable spatial distribution of community assets to improve food security, including urban farms, community gardens, food markets, and healthy food options

EMERGENCY PREPAREDNESS AND RESPONSE

- Designate appropriate facilities as emergency shelters that are equipped with back-up electric generation
- Maintain public health and safety during extreme weather events
- Ensure all residents are prepared to respond to emergency situations
- Ensure mobility options and transportation plans are available to those most vulnerable during times of emergency
- Develop and promote educational materials on the health impacts of air pollution, extreme heat, longer allergy seasons, and vector-borne diseases
- Communicate which facilities are open to the public during times of extreme weather
- Ensure emergency communications are available in multiple languages and interpreters are available
- Coordinate with the County to plan for emergency debris management
- Engage faith, civic, and citizen groups to partner with the city to design and implement emergency preparedness for residents

Photo Credit: Great Plains Institute

Photo Credit: Great Plains Institute

Natural Infrastructure

Protect natural infrastructure and enhance it to maximize its ability to mitigate weather and climate impacts

URBAN FOREST & WATER QUALITY

- Update the citywide urban tree canopy assessment every ten years and maintain a current street tree inventory to achieve at least 40% citywide canopy coverage and 15% canopy coverage in downtown, consistent with the 2040 Comprehensive Plan
- Accelerate tree replacement programming in neighborhoods that will be most impacted by urban heat island effect and Emerald Ash Borer
- Prioritize tree planting in areas of concentrated poverty and low tree canopy coverage
- Build relationships and trust with community members; support early maintenance and care of trees
- Engage faith, civic, and citizen groups to partner to organize volunteer opportunities to plant public and private trees
- Consider rooftop solar access in commercial and industrial districts when determining which types of trees to plant
- Promote the proactive replacement of declining ash trees with a diverse mix of species to build urban forest resiliency and maintain canopy cover
- Use vegetative cover to help stabilize slopes, reduce slope failure, and minimize waterbody sedimentation
- Expand and connect green spaces so they are welcoming and within walking distance of all residents, especially in underserved communities where there are greater proportions of impervious surfaces
- Improve the ecological functionality of and resiliency of parks and open space through green infrastructure, best practices for stormwater management, and increased plant diversity and pollinator-friendly habitat
- Foster environmental stewardship, community health, and cultural and ecological learnings along the Mississippi River through the implementation of the Great River Passage Initiative
- Encourage the use of low-impact landscaping to reduce consumption of water and chemicals in yard and lawn maintenance, improve permeability to reduce stormwater runoff, and sequester more carbon in soil
- Encourage the use of Minimal Impact Design Standards (MIDs) for new development
- Ensure availability of high quality compost from organics collection to businesses and residents to help improve soil quality
- Ensure water treatment and distribution infrastructure is resilient to potential hazards
- Support regional efforts to address groundwater usage and recharge
- Collaborate with partner agencies on water quality improvement efforts, including capital projects and programming
- Implement additional strategies included in the 2040 Comprehensive Plan to improve the resilience of natural infrastructure through an equity lens

Built Infrastructure

Ensure the long-term integrity and reliability of built infrastructure systems by considering future climate impacts in long-term planning

- Include life-cycle costs when preparing asset management plans and selecting construction materials and equipment for city projects
- Explicitly incorporate resilience into the capital improvement planning process
- Identify critical infrastructure facilities and ensure there is reliable, clean back-up energy in case of a power outage
- Pilot opportunities to test and demonstrate the value of a smart grid or microgrid technologies, including tie-ins with electric vehicles and solar plus storage
- Work with the electric utility to bury distribution lines when feasible
- Invest in cost-effective materials for road surfaces that are robust enough to withstand extreme weather events, including heavy precipitation and freeze/thaw cycles
- Install white roof or high albedo membrane on low slope municipal rooftops to reflect heat from the sun and reduce urban heat island effect
- Encourage the installation of white roof or high albedo membrane on privately owned, low slope rooftops
- Encourage the installation of green roofs, when feasible, on flat rooftops
- Assess city-owned buildings and sites for vulnerabilities to extreme weather, and make investments to reduce or prevent damage and sustain function
- Reduce impervious surfaces where possible, and use lighter colored pavements and building materials to lessen the impact of urban heat island effect

Photo Credit: Great Plains Institute

CLIMATE CHANGE MITIGATION

To mitigate our impact on climate change, we need to change where our energy comes from and how we use it. Fossil fuels have long been the driver of economic growth throughout the world. We know that we can expect to maintain a high quality of life with alternative forms of energy and through changes in our habits. Reducing emissions requires displacing fossil fuels with carbon-free energy sources to generate electricity, deliver heating fuel, and power our vehicles. It also means using less through efficiency and conservation, cleaner modes of transportation, and modifying our diets. Many of these shifts can provide other co-benefits to our lives, such as improving physical and mental health, saving money, and creating jobs. As much as possible, low-carbon alternatives will need to be made as available, affordable, and convenient as the products they are replacing.

Some of these changes will have to occur at the system level. For instance, Xcel Energy provides electricity to businesses and residents of Saint Paul and is largely responsible for how electricity is generated. Over the past several years, Xcel has taken steps to remove carbon from its generation mix by adding wind and solar while reducing coal generation. The company is committed to continuing to reduce the carbon intensity of its generation mix such that it intends to be entirely carbon-free by the year 2050. Because of this shift in generation, Saint Paul will have more flexibility to focus on other areas of carbon reduction, particularly transportation, heating, efficiency, and distributed energy resources, like solar, geothermal, and demand response technology. In the longer-term, this plan aims to reduce building energy consumption 50% by 2050 through deep energy efficiency measures and net zero building energy standards. In the near-term, 2030 targets include increasing local solar development to 200 MW, reducing vehicle miles traveled by 25%, and electrifying 33% of the remaining share of vehicles.

What you can do to reduce emissions

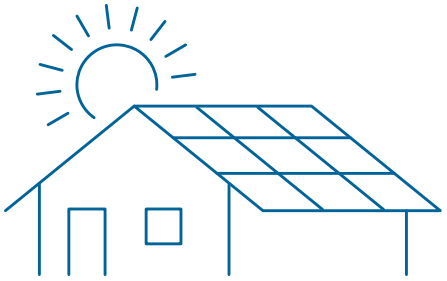
To achieve the greenhouse gas (GHG) emissions reductions necessary to avoid the worst impacts of climate change it will take a massive effort at all levels of government throughout the world and a major shift from individual actors. Collectively, big actions from many individuals around the world will both add up to measured reductions and put more pressure on markets to shift toward low-carbon technologies and motivate governments to act. A 2017 study from researchers in Sweden and Canada found the most impactful actions individuals can take and how they stack up to one another. The following is a summary of what you can do to maximize your impact on climate change.

Most actions don't require big life changes, just simple shifts in how you go about your day. There is flexibility in each action that allows individuals to tailor them to the demands of their lives. The graphic illustrates nine actions that can be taken by individuals with the greatest potential to shift emissions toward a downward trajectory.

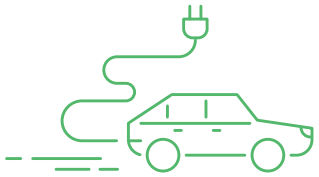
What actions can you take to reduce greenhouse gas emissions in your life? It all adds up!

1. LIVE CAR-FREE

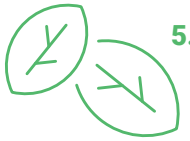
2. TAKE FEWER FLIGHTS



3. PURCHASE OR INSTALL GREEN ENERGY



4. REDUCE EFFECTS OF DRIVING



5. EAT A PLANT-BASED DIET

6. HOME ENERGY EFFICIENCY

7. REDUCE FOOD WASTE

8. REDUCE WASTE

9. EAT LOCAL & IN SEASON

1. Live car-free. The action with the greatest impact is to live a car-free life. While it's possible to live car-free, it can be challenging as current transit and mobility options do not always fit commutes or daily transportation needs. However, the way we move people is rapidly changing as technologies and preferences evolve. Saint Paul is actively seeking opportunities and projects to enable individuals and families to reduce car trips. From supporting shared micro-mobility options to improving bike and pedestrian facilities, there are more choices than ever to get around the city.

2. Take fewer flights. Airplane travel is the greatest source of per mile transportation emissions for those who fly. Often, business travel is unavoidable, but companies and organizations are increasingly open to other communication platforms. Video conferencing has become a more common alternative to in-person meetings. Regional trains are another lower carbon alternative to shorter flights.

3. Purchase or install green energy. While Xcel Energy is cleaning up its generation mix, there is still a role for individuals to play in accelerating the green energy economy. For those with a good solar resource, consider adding solar to your rooftop. Non-rooftop options include subscribing to a community solar garden or purchasing renewable energy credits through Xcel Energy's WindSource® or Renewable*Connect® programs. Accessing clean energy locally can have benefits to residents and businesses by decreasing electricity bills and creating jobs in the community while also reducing emissions from power plants.

4. Reduce effects of driving. An alternative to living car-free is to drive less. Consider telecommuting one day a week if your job allows. Mobility options include taking transit, biking, and carpooling. The transportation system is rapidly shifting to allow for a multitude of non-personal vehicle options. Electric bikes and scooters are increasingly popular and allow users to go farther in a shorter time than they would have on foot or a pedal-powered bike. Getting out of your car offers physical and mental health benefits as well. Another option is to replace at least one car with an electric or high-efficiency vehicle.

5. Eat a plant-based diet. Shifting to a low-meat or plant-based diet is one of the biggest impact actions individuals can take. This could mean reducing the amount of meat you eat each month. Overall, the livestock industry is responsible for around 15% of global human-cause ghg emissions. Approximately 80% of these emissions come directly from ruminant animals, such as cattle.

6. Home energy efficiency. Home energy efficiency will help reduce monthly bills while making your home more comfortable and reducing emissions. Get a home energy audit to understand how your home is using energy and where you can make improvements, like adding insulation and air sealing. As electricity generation becomes cleaner, consider switching appliances that run on natural gas, like your oven range, water heater, or dryer to an electric alternative.

7. Reduce food waste. Food waste is responsible for about 8% of global emissions. Food that is discarded into a landfill decomposes and releases methane, a powerful greenhouse gas. In Ramsey County, 26% of waste is from food. Food waste prevention strategies include planned shopping, right-sizing portions, planning for leftovers, freezing food, composting, donating, and checking food for freshness rather than use-by date.

8. Reduce waste. Using less is the best way to decrease the resources, landfill space, and energy associated with any product. Eliminate single-use products like plastic bags, plastic utensils, and plastic water bottles. Instead, invest in a sturdy tote bag, reusable utensils, and a reusable water bottle. Some single-use items like leaf blowers or pressure washers can be borrowed or rented instead of purchased.

9. Eat local and in season. In the Midwest, most fresh fruits and vegetables have already traveled 1,500 miles before arriving at your local grocery store. By purchasing locally grown food, you can reduce the impact of that transportation. Saint Paul has a strong Hmong farming community that has been a major force in the expansion of local food markets and small farms. Buying from farmers' markets and participating in community-supported agriculture can reduce the carbon footprint of your food.

COMMUNITY EMISSIONS PROFILE

A community's emissions profile is made up of greenhouse gas emissions across different sectors and energy sources. The Saint Paul greenhouse gas (GHG) inventory includes energy use from residential, commercial, and industrial sources for buildings; emissions from on-road vehicle travel; and other emissions from solid waste, water, and wastewater. While this is not an exhaustive list of emissions that businesses and residents are responsible for, it is a good assessment of the emissions where there is some level of local control. For instance, emissions that result from producing consumable goods are not included in the community inventory, but would show a significant increase of per person emissions. Other major sources of emissions that are not included in this plan, but are included in the city's official inventory, are Xcel Energy's High Bridge Generating Plant, District Energy, and the portion of the Minneapolis-Saint Paul International Airport that can be attributed to Saint Paul residents. These were excluded from this plan as the city has limited authority to influence those emissions, however they are not insignificant and amount to approximately 1.2 million tons of CO_2 each year. The following summarizes the GHG emissions inventory for the City of Saint Paul.

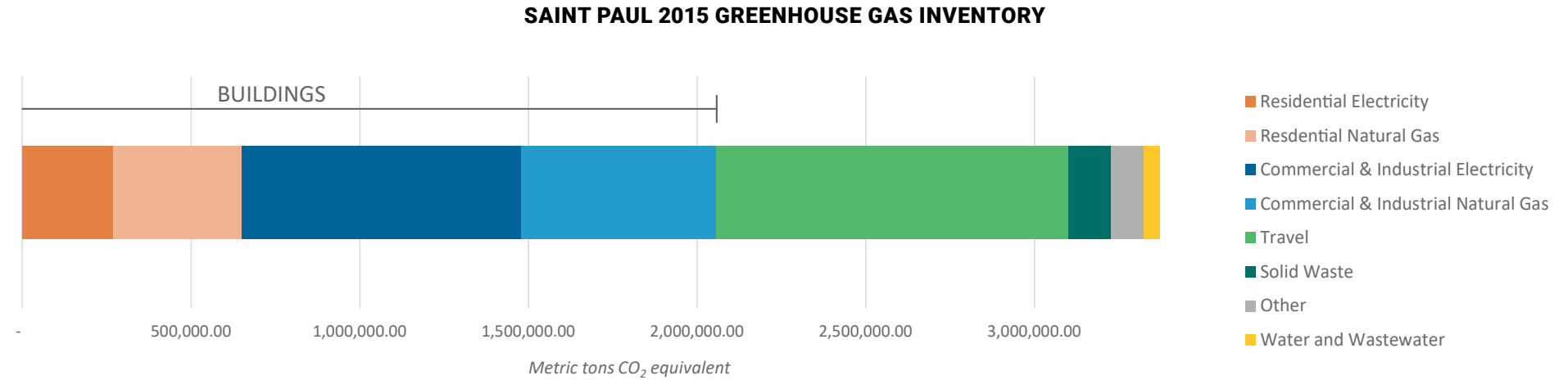


Figure 3: Saint Paul 2015 Greenhouse Gas Inventory. Data sources: Xcel Energy natural gas and electricity use (2015), Minnesota Department of Transportation vehicle miles traveled (2015)

In Saint Paul, the majority of emissions in 2015 came from building energy use (61%), followed by travel (31%). Solid waste makes up about 4% of total emissions, while water and waste water account for 1%. The remaining emissions come from the losses in the delivery of energy and include natural gas leaks and grid loss along transmission and distribution lines. For more information on the GHG assessment see Appendix A.

The following sections provide detailed background information for each sector, and priorities for addressing GHG emissions to maximize benefits to residents and businesses.

BUILDING SECTOR

In June of 2017, Saint Paul completed a climate action plan for its building stock through the Partners in Energy (PiE) program offered by Xcel Energy. The PiE plan guides the city's buildings to carbon neutrality by 2050. Sections of that plan are incorporated herein to support the Climate Action and Resilience Plan by reducing emissions from the building sector including residential, commercial, and industrial properties. For the full PiE plan, see Appendix D.

For the development of the PiE plan, a Technical Advisory Group was convened. The group consisted of local energy and building sector experts whose goal was to assess the technical feasibility of the strategies and advise city staff and officials on impact and prioritization. Through this process, the group shared its inspirations for Saint Paul's energy future and imagined a city that has achieved our energy goals as a guide to creating a unified vision statement:

By expanding energy efficiency, conservation, and energy recovery, as well as energy storage, renewable energy, and distributed energy, Saint Paul has achieved carbon neutrality in the built environment and fortified our resilience to climate change by the year 2050. Saint Paul has achieved this remarkable goal by intentionally and consistently engaging the public toward locally relevant solutions. All views — especially those of the traditionally underrepresented — have been heard and respected, and all residents, regardless of housing type or income, have benefited from the clean energy economy transition and are safeguarded from adversity.

Guiding Themes

The near-term strategies in this plan are also linked to important guiding themes for the city:

- Prioritize conservation, energy efficiency, and energy recovery
- Prioritize renewable-based distributed generation and energy storage
- Ensure solutions and opportunities are equitable, particularly in communities and households of color
- Commit to reducing the energy burden on low- to moderate-income residents
- Focus on efforts that result in co-benefits (e.g. employment, economic development, other environmental benefits such as water conservation and improved air quality)
- Showcase best practices and innovative solutions

The Path to Carbon Neutrality

Attaining carbon neutrality in just over 30 years will require aggressive efforts to reduce overall building energy use through efficiency and conservation and convert current energy sources to renewable or carbon-free. The scale of this effort will also depend on how Saint Paul's underlying energy needs are growing and on projections for the carbon intensity of the regional electricity supply. As mentioned, Xcel Energy delivers electricity to Saint Paul and is expected to make significant steps to decarbonize its generation mix between now and 2030, and then to fully decarbonize by 2050. The 2030 changes alone would bring Saint Paul 40% of the way toward carbon neutrality in its building sector by 2050.

Photo Credit: Great Plains Institute

PROJECTED CARBON EMISSIONS UNDER A 1% BUSINESS AS USUAL GROWTH SCENARIO

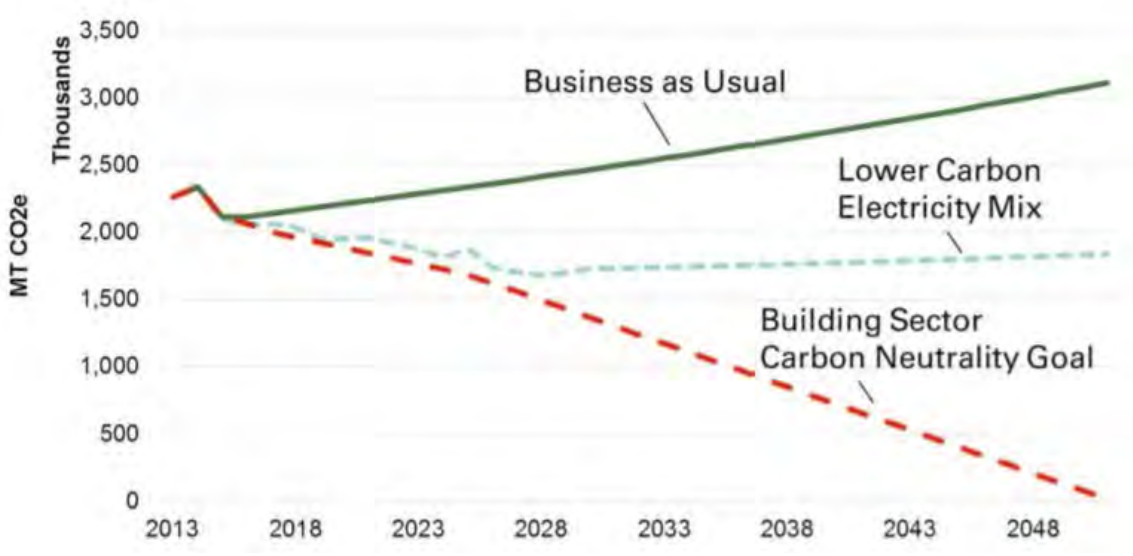


Figure 4: Saint Paul's Path to Carbon Neutrality: Buildings Sector. Source: Partners in Energy: Saint Paul's Path to Carbon Neutrality: Buildings Sector

Building Priorities

- ***Inspire a culture of energy stewardship.*** Inspire a cultural shift that transforms the community's relationship to energy use, tripling the incremental annual savings from residential conservation and renewable energy adoption within 10 years
- ***Reduce resident energy burden.*** Within 10 years, lower the energy burden so that no Saint Paul household spends more than 4% of household income on energy costs
- ***Engage major public and private institutions on climate leadership.*** (1) Within three years, win commitments of major institutions to achieve carbon neutrality by 2050 and ensure 80% of institutional buildings are actively benchmarked, and (2) within 10 years, help institutions realize a 35% total GHG reduction, with energy efficiency as a leading strategy
- ***Engage the multifamily and large commercial sector.*** Adopt multifamily and large commercial sector conservation and renewable energy initiatives that result in an additional 4% annual reduction in GHG emissions for those sectors
- ***Inspire through municipal leadership.*** Achieve carbon neutrality in municipal building operations by 2030

Combined, the sectors targeted in these five priority areas accounted for 58% of the building electricity use and 74% of building natural gas use in 2015. Within 10 years, the associated strategies will reduce GHG emissions by 435,000 metric tons of carbon dioxide equivalent (CO_2e), or 21% below 2015 levels.

RESIDENTIAL ENERGY USE

In 2015, Saint Paul residents and businesses consumed a total of 2.7 billion kWh of electricity and 155 million therms of natural gas. Residential premises used 25% of the electricity and 46% of the community-wide natural gas, which accounted for 19% of total emissions in the city. The portion of residential gas use is significantly higher than electricity use. This may be due in part to the fact that space heating is a large load for single-family homes in Minnesota.

The maps on the next page show the average electricity and natural gas use of residential premises across the city at the census tract level. This variation is due to several factors, including the mix of housing stock (i.e. age and size of homes), previous energy efficiency investments, household size, and the types of energy use activities within a home.

Saint Paul residents spent a total of $128 million on energy in 2015. On average, households spend a total of $1,424 per year on electricity and natural gas.

SAINT PAUL AVERAGE ENERGY COSTS (BASED ON THREE-YEAR AVERAGES)

Customer Type	Average Electricity Cost ($/premise/year)	Average Gas Cost ($/premise/year)
Residential	$717	$707

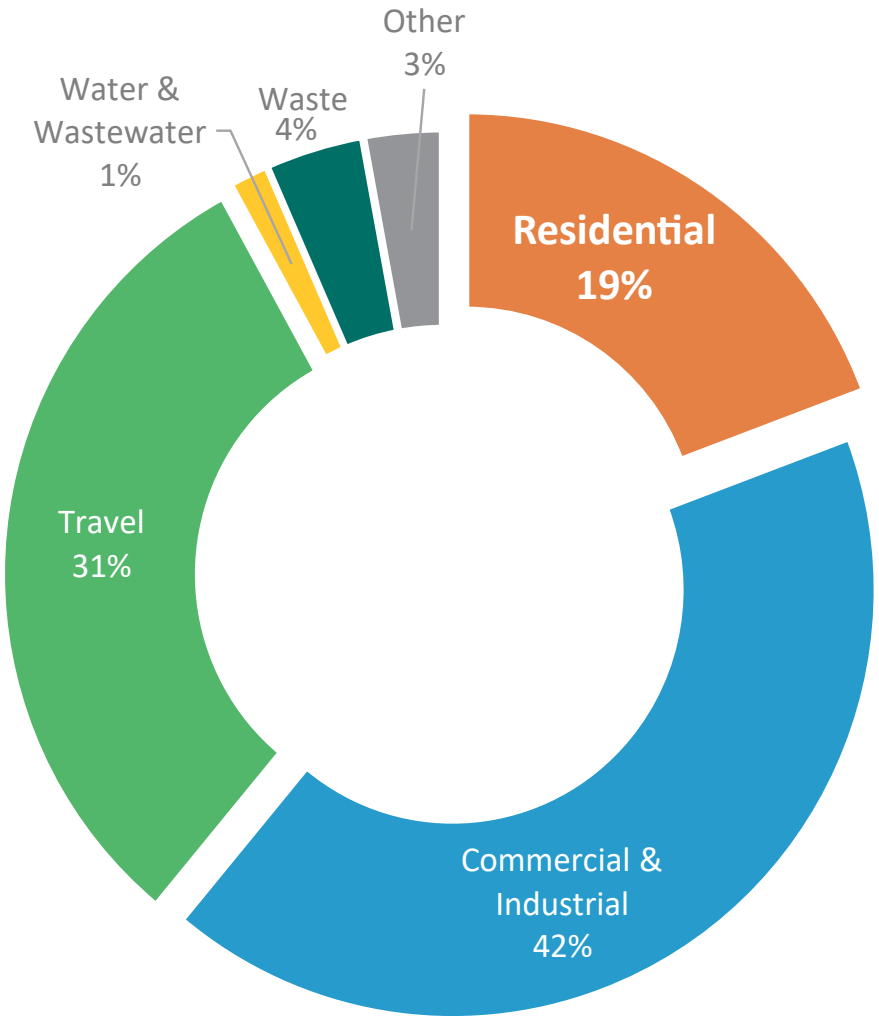
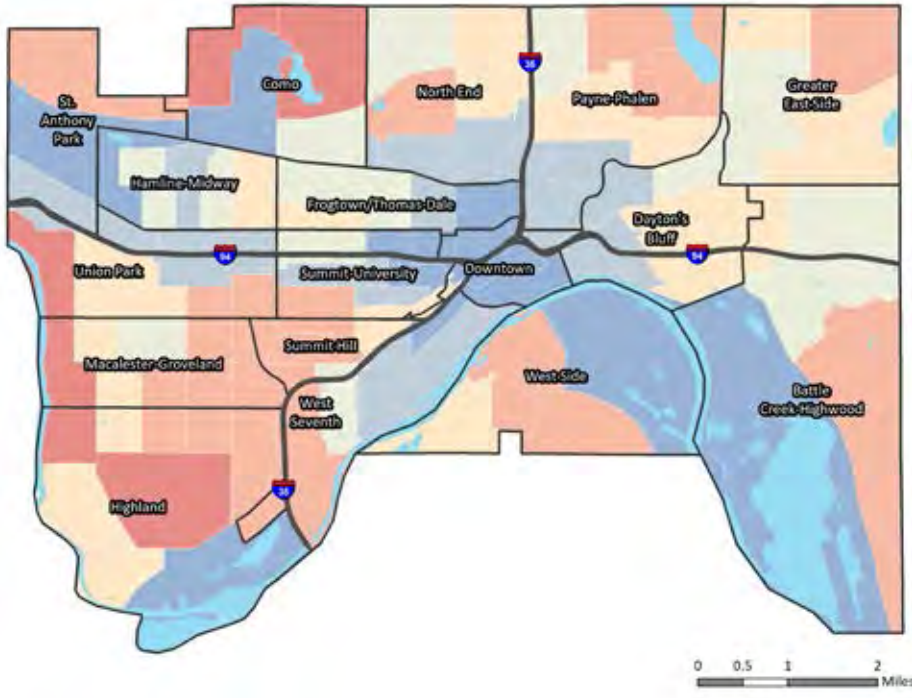
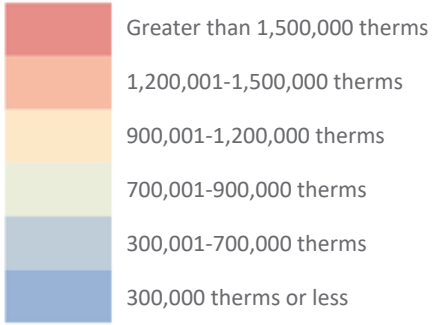


Figure 5: Emissions by sector.

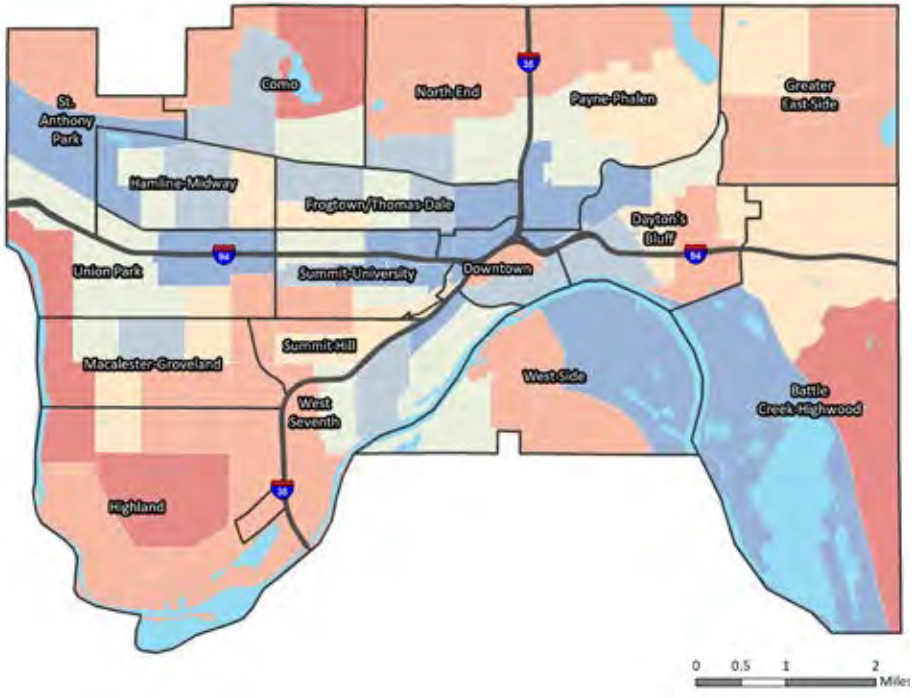
AVERAGE ANNUAL RESIDENTIAL NATURAL GAS USE



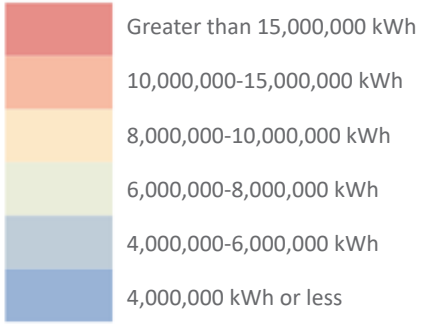
Map 7. Average annual residential natural gas use in therms by census tract (Xcel Energy, 2015)



AVERAGE ANNUAL RESIDENTIAL ELECTRICITY USE



Map 8. Average annual residential electricity use in kWh by census tract (Xcel Energy, 2015)

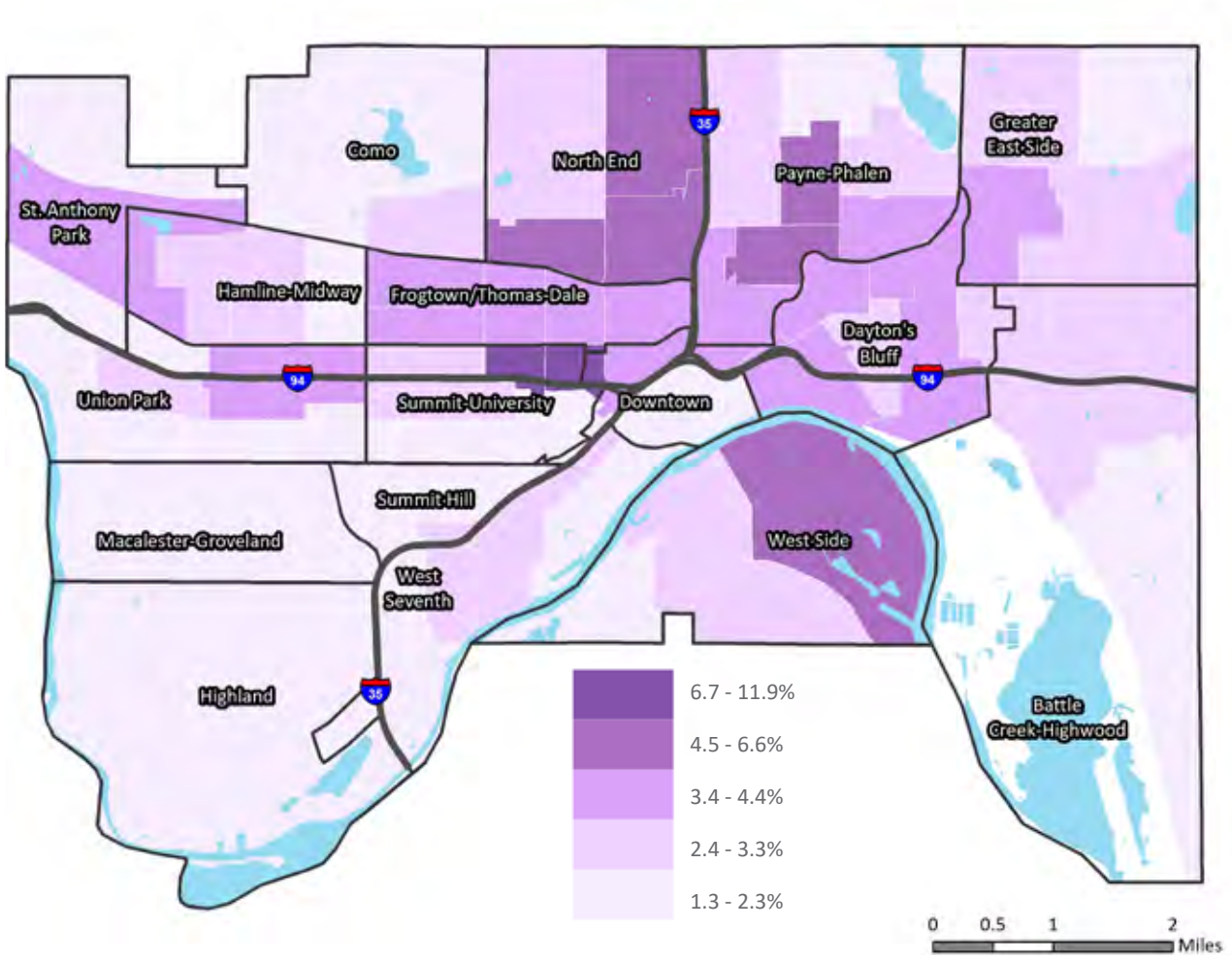


Residential Energy Burden

Energy Burden is defined as the percent of household income spent annually on energy. Understanding energy burden and how it is distributed across neighborhoods, racial and ethnic groups, and household types can help to better target low-income energy efficiency programs in Saint Paul. According to a 2016 report from the American Council for an Energy-Efficient Economy that looked at the Twin Cities metro region as a whole, the median energy burden for a household in the Twin Cities is 2.32%. For low-income households, the median energy burden is 5.11% and is as high as 8.20% for some households, according the report.

Analysis performed through Partners in Energy shows that the 10 census tracts with the highest median energy burden range from 4.2% to 12%. Note that this number may be conservative, as it only includes dollars spent directly on energy purchases (not taxes and fees) and may exclude indirect residential expenditures on natural gas (as in the case of multifamily buildings that purchase gas on commercial tariffs).

Based on further calculation, there are approximately 42,124 households in Saint Paul experiencing an energy burden of 4% or above. Lowering energy burden to below 4% for all Saint Paul households would save an estimated 13.5 million kWh of electricity and 1.3 million therms of natural gas each year, resulting in an average annual cost savings of $2.4 million.



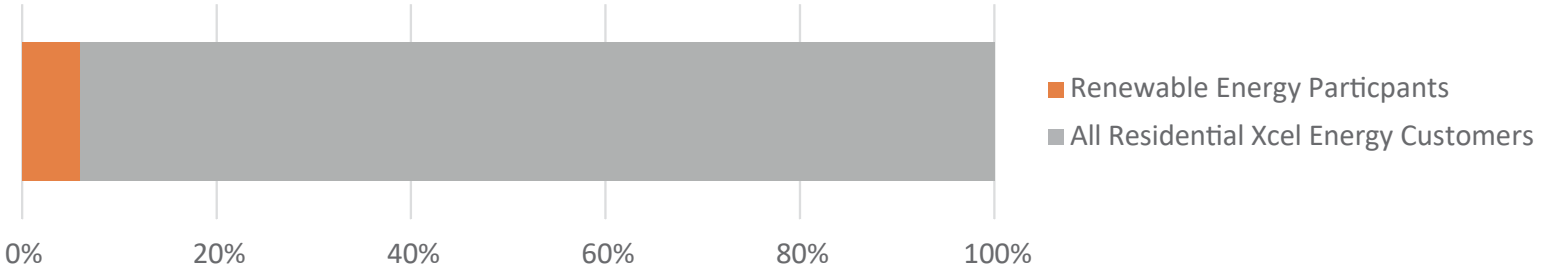
Map 9. Median energy burden by census tract. All energy consumption data are from 2015 and have not been weather normalized, per the Partners in Energy report.

Participation in Conservation and Renewable Energy Programs

In addition to energy use, historic participation in Xcel Energy Conservation Improvement Programs (CIP) provides useful data on current trends and future opportunities. Between June 2013 and May 2016, Saint Paul residents took almost 17,000 efficiency program actions. These efforts add up to approximately 7.3 million kWh of electricity and 1.2 million therms of natural gas saved annually, equal to a reduction in energy bills by $1.68 million per year. Averaged over the 3-year period, this is equivalent to 0.5% of annual 2015 residential energy use.

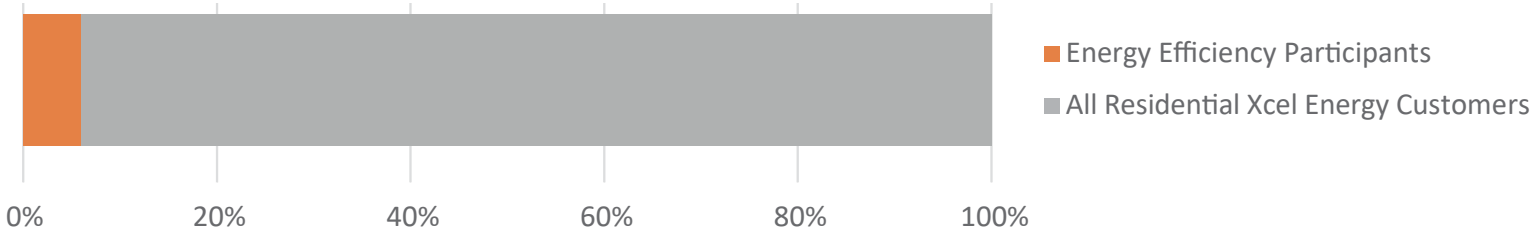
The most popular programs by number of participants were Saver's Switch, residential heating, and the Low-income Home Energy Squad. The top programs by energy savings were residential heating, Home Energy Squad, and Low-Income Home Energy Squad. Xcel Energy also provides information related to participation in renewable energy programs including on-site solar installation and green power purchase programs, like WindSource® and Renewable*Connect®. Participation in these two programs and associated renewable generation are included in the graph below. The graph represents the number of customers participating in renewable energy programs; about 6.32% of all residential electric customers are represented.

RESIDENTIAL PARTICIPATION IN RENEWABLE ENERGY PROGRAMS



Similarly, approximately 6.34% of residential customers participate in energy efficiency programs. This is not a full representation of the number of customers who take actions to reduce energy use as not all customers utilize the utility incentives that are available.

RESIDENTIAL PARTICIPATION IN ENERGY EFFICIENCY PROGRAMS

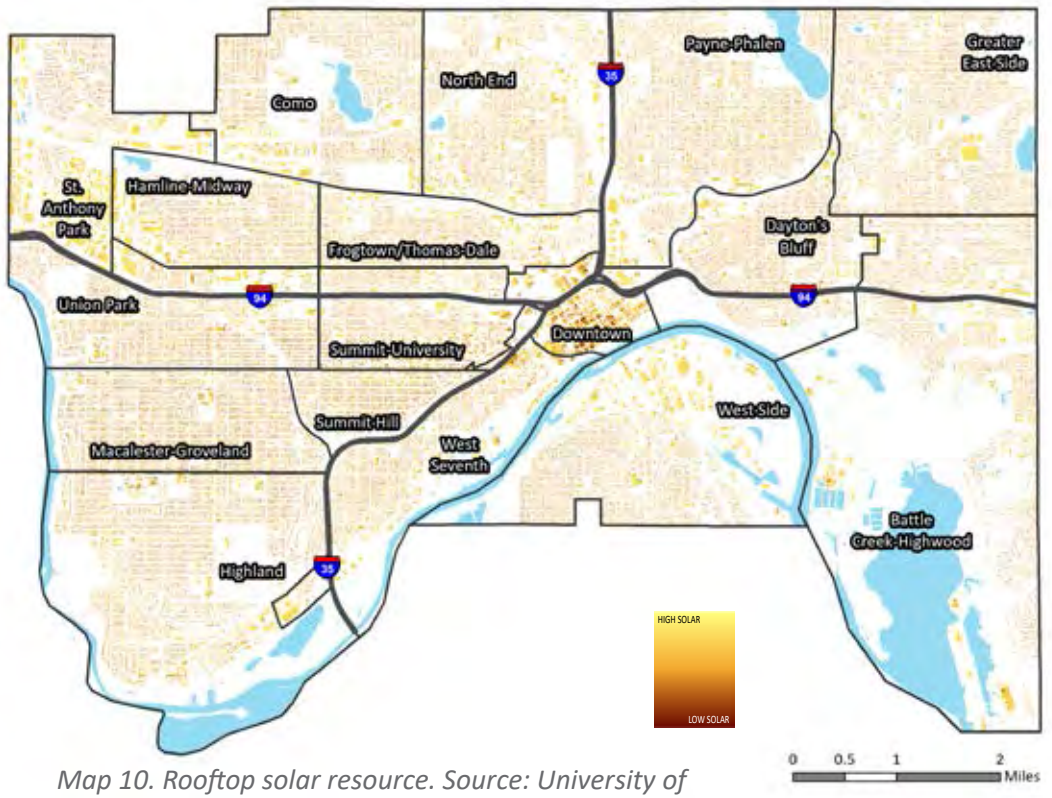


Local Solar Energy

Increasingly, solar energy is becoming a more accessible and affordable technology to generate local electricity. Beyond generating clean electricity, solar energy systems can also have local economic impacts. Residents and businesses who install solar panels on their rooftops receive the economic benefit of free electricity generation. Local installations also create local job opportunities. Xcel Energy offers income-qualified incentive programs for both rooftop solar installations and participation in community solar gardens, increasing access to affordable electricity generation for more people. Solar offers additional resilience benefits to local community members. Installations can be designed so that during times of power outages solar can be paired with a back-up battery system to continue to provide electricity to a home, business, or critical infrastructure.

Saint Paul has a good rooftop solar resource. If solar were installed on all rooftops with a decent rooftop potential, there could be a solar capacity greater than 800 MW, or about 40% of the city's total electricity consumption. The ten largest buildings alone could have enough solar potential to achieve close to 1.5% of the city's electricity consumption with space available for approximately 26 MW of capacity. This plan recommends 100 MW of capacity be installed on commercial rooftops, which would require about 25% of the total available roof space. The map at right shows the solar resource potential for all building rooftops across the city.

Annual installations of rooftop solar have grown rapidly since 2010. The graph at the right illustrates both the annual increase in installations of rooftop solar energy systems and the cumulative capacity of solar energy within the city. The current capacity of solar in Saint Paul is approximately 7.1 MW. This trend is expected to continue as the cost of installations decline and more people choose to participate in solar.



Map 10. Rooftop solar resource. Source: University of Minnesota Solar Suitability Analysis.

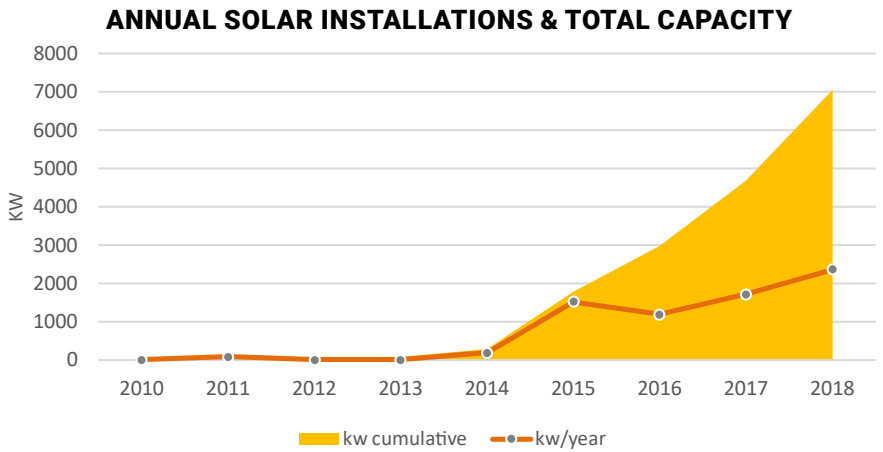


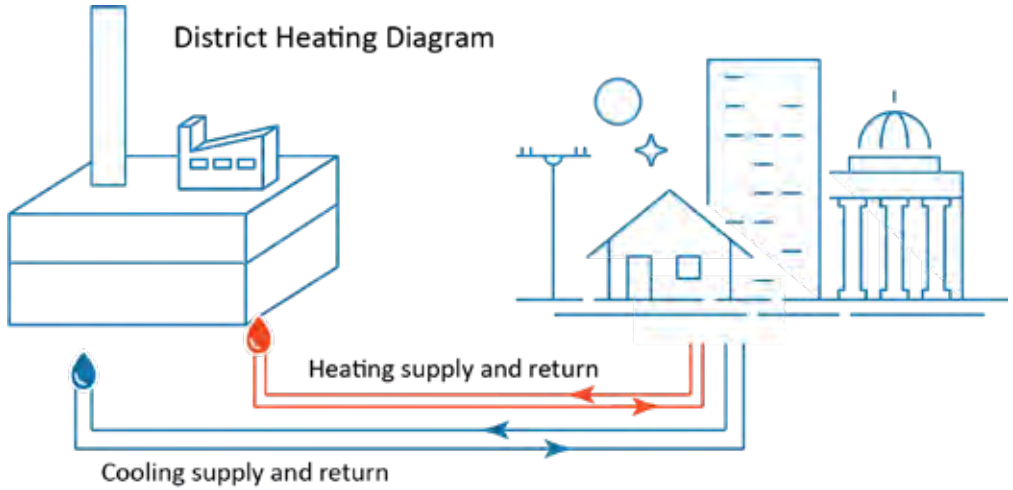
Figure 6: Annual solar installations and total capacity in St. Paul. Source: City of Saint Paul.

Thermal Opportunities: Combined Heat and Power (CHP) & District Heating and Cooling

Natural gas accounts for 28% of total emissions in Saint Paul. It is most commonly used for space and water heating, cooking, and industrial processes. While energy efficiency has the potential to significantly reduce natural gas consumption in buildings, it alone will not be enough to help the city achieve its climate goals. Innovative thermal solutions will need to be deployed to drive deeper emissions reductions. In some instances, appliances can more easily be switched to electric sources, like water heaters and oven/ranges. There are other thermal technologies that already exist in Saint Paul that have the potential to significantly impact natural gas consumption in the city, they include combined heat and power and district heating.

More than 200 buildings in downtown Saint Paul and 300 single family homes have their heating and cooling needs met through a district heating system tied to District Energy. Using a combined heat and power system, District Energy sends hot and chilled water to buildings to meet heating and cooling needs. At the plant, electricity is generated from a steam turbine which is fueled by biomass (organic matter used as a fuel) and natural gas-fired boilers and sold to the grid. The heat that is produced in this process is delivered to customers as hot water and used to meet thermal needs. In 2019, District Energy stopped burning coal to generate power, reducing its emissions by about 10,000 tons of CO_2 each year.

Electricity generation is one example of how waste heat can be used for thermal needs, but there are other processes that produce waste heat and could be tied into a district heating system. For instance, many industrial processes generate significant amounts of heat that is sent through stacks into the atmosphere when it could otherwise be used to meet heating and cooling loads. The Minnesota Department of Commerce is planning to map CHP opportunities in the state to support planning future projects.



WHAT IS COMBINED HEAT AND POWER?

Combined heat and power systems (CHP) generate electricity and useful thermal energy simultaneously. Most power generation systems generate heat in the process of producing electricity; CHP systems put that thermal energy to use.

Thermal demand for heating buildings, domestic hot water, industrial processes, and cooling can be met by CHP systems, reducing greenhouse gas emissions that result from inputs that typically meet those loads.

This technology is well established in Minnesota, but underutilized. Currently, there are 962 MW of CHP capacity installed with an estimated potential of more than 3,000 MW. CHP is an important part of improving the efficiency of heating and cooling loads, and the efficiency of power generation.

COMMERCIAL AND INDUSTRIAL ENERGY USE

Saint Paul has a large downtown area, with several high-rise commercial buildings as well as historic buildings including the Landmark Center, the State Capitol building, and the Cathedral of Saint Paul. Saint Paul's downtown is also home to restaurants, art galleries, entertainment venues, museums, and sports arenas.

Buildings classified as commercial properties include a wide range of use types and reflect the large government and institutional presence in Saint Paul. Of the properties recorded as having over 25,000 square feet, the largest use category are properties classified as general commercial, which includes offices and retail spaces. After that, the largest special use categories by building count are public schools, churches, charitable institutions, municipal services, special tax districts, state property, and colleges and universities.

Saint Paul's commercial buildings were constructed throughout the city's 160-year history, though the heaviest construction period occurred between 1950 and 1975.

As mentioned previously, in 2015, Saint Paul had a total of 126,530 premises, 11% of which were commercial and industrial. Of the 2.7 billion kWh of electricity and 155 million therms of natural gas, the majority was consumed by the commercial and industrial premises. These premises represent 75% of the electricity and 54% of the natural gas consumption in the city and represent 42% of community-wide emissions.

A large part of Saint Paul's downtown is served by District Energy Saint Paul, a thermal energy grid connected to a combined heat and power generating plant located on the banks of the Mississippi River. District Energy Saint Paul uses a mix of biomass and fossil fuels to generate both hot and chilled water, which is then piped to downtown customers.

Saint Paul businesses spent a total of $218 million on energy in 2015. On average $17,208 was spent per year on electricity and natural gas.

SAINT PAUL AVERAGE ENERGY COSTS (BASED ON THREE-YEAR AVERAGES)

Customer Type	Average Electricity Cost ($/premise/year)	Average Gas Cost ($/premise/year)
Commercial & Industrial	$13,082	$4,126

Emissions by Sector

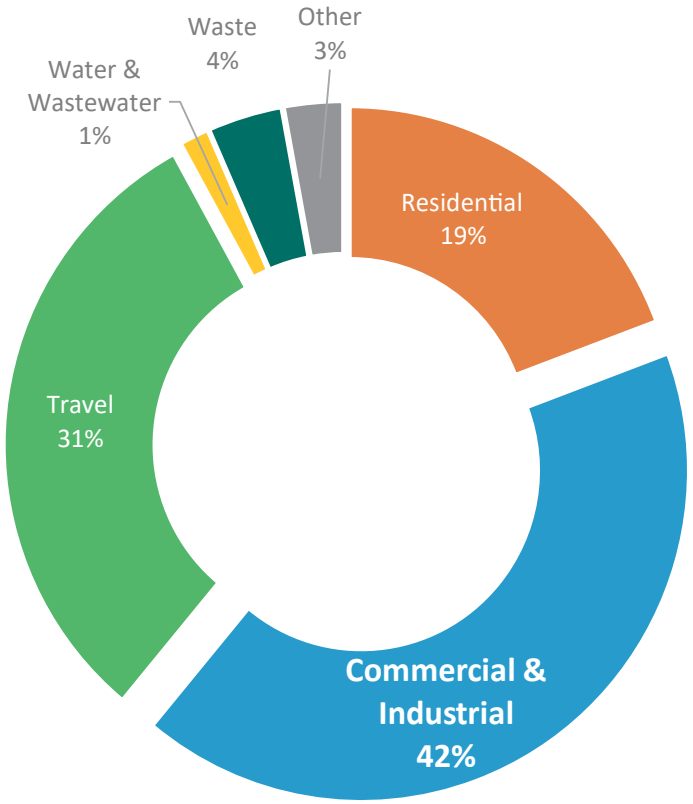


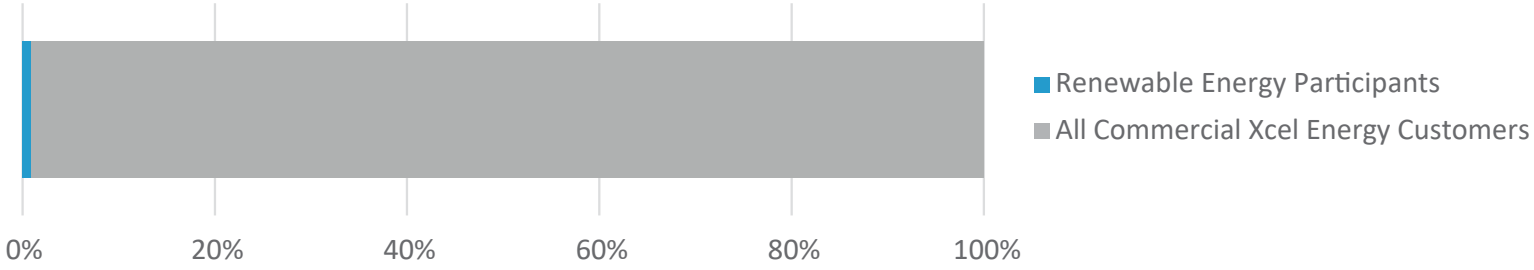
Figure 7: Emissions by sector.

Participation in Efficiency and Renewable Energy Programs

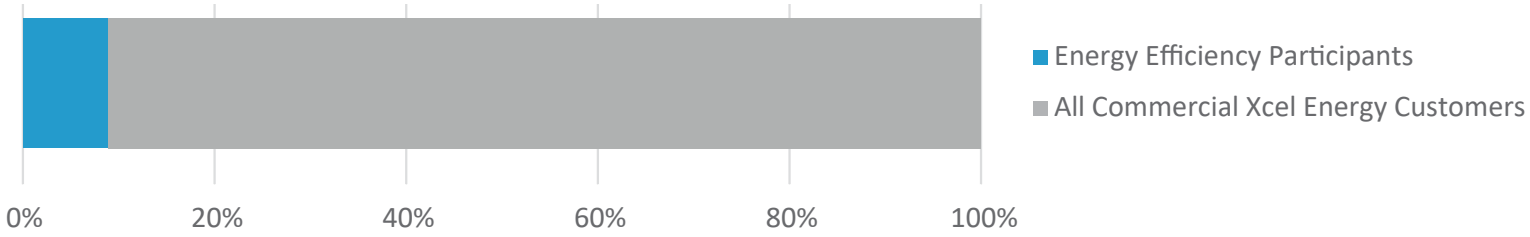
Between June 2013 and May 2016, Saint Paul businesses took almost 3,000 efficiency program actions. Combined, these investments saved approximately 91 million kWh of electricity and 2.8 million therms of natural gas per year, which amounts to an annual savings of approximately $8.96 million. When savings are averaged over the three-year period, this is equivalent to 1.3% of annual commercial and industrial energy use.

The most popular programs by number of participants were lighting efficiency, small business lighting, and Saver's Switch. The top programs by energy savings were heating efficiency, Energy Design Assistance, and the custom efficiency program. Further detail is provided in the complete PiE plan. Participation in associated renewable generation and efficiency programs are included in the graph below. Just under 1% (.95%) of commercial customers participated in renewable energy programs, while nearly 10% (9.80%) participated in energy efficiency programs in 2017.

COMMERCIAL PARTICIPATION IN RENEWABLE ENERGY PROGRAMS



COMMERCIAL PARTICIPATION IN ENERGY EFFICIENCY PROGRAMS



TRANSPORTATION & MOBILITY

Transportation today has surpassed the electricity generation sector as the largest source of carbon emissions and is growing. Eliminating transportation emissions is critical to achieving the goal of carbon neutrality by 2050. Transportation accounts for approximately 30% of all Saint Paul emissions today, a yearly total of 1.02 million metric tons of carbon dioxide equivalent ($MMTCO_2e$). A majority of trips are carried out by car, often driving alone.

Transportation emissions are influenced by three main factors:

1. ***Land use and urban form***—where people are located and where they are going affect how often trips are made and how long they are. If destinations are farther away and more dispersed, a higher number of trips will have to be made over longer distances
2. ***Mode of transportation***—whether people are driving, walking, biking or taking transit
3. ***What fuels are used***—gasoline, diesel, biofuels, electricity, or people power

Since the creation of the interstate system in the 1950s, cities across the country were redesigned to predominantly accommodate the automobile, leaving less room for other modes of transportation including transit, walking, and biking, and Saint Paul is no exception. Eighty percent of city travel is by car, often carrying a single passenger. People drive about 2 billion miles a year in Saint Paul, or about 5.5 million miles a day. Driving alone is by far the most energy intensive mode of surface transportation. On average, a car uses 3,000 British thermal units (BTU) per passenger mile traveled, compared to 800 BTU for transit rail – in addition to the significant amounts of energy used to manufacture automobiles and the acres of pavement dedicated to their storage and movement. Saint Paul is projected to add an additional 30,000 residents by 2030. If current transportation trends continue, this growth is likely to increase car usage, congestion, and associated greenhouse gas emissions.

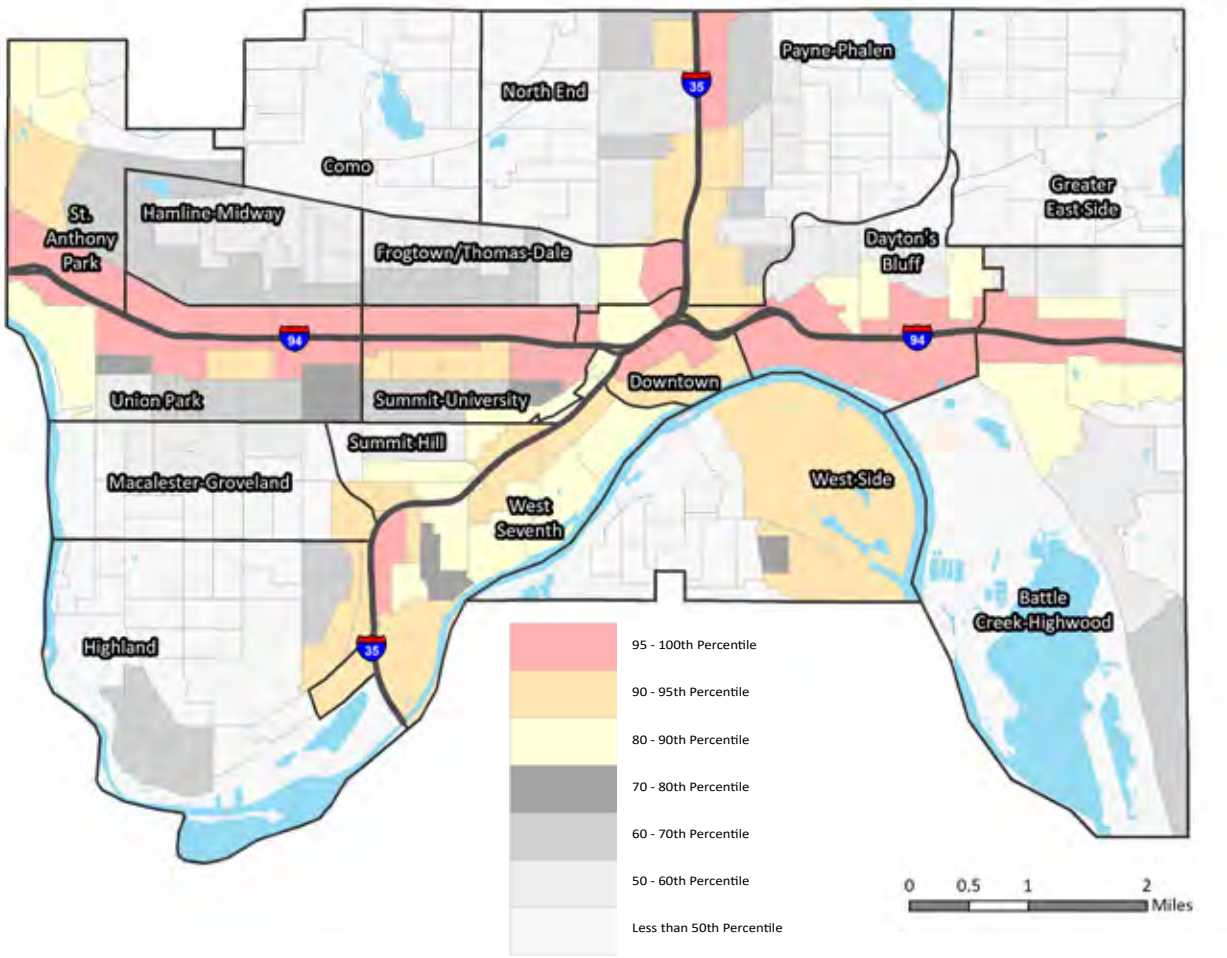
Transportation and land use decision-making has an outsized influence on how communities are shaped. Access to destinations mitigates racial segregation, income inequality, and promotes family stability. Historically, transportation projects have often resulted in disproportionate negative impacts on marginalized communities. For example, major downtown highways in the 1950s were intentionally routed through communities of color such as the Rondo neighborhood in Saint Paul, which was and is predominantly African American. As a result of these transportation projects, communities of color are more likely to be situated in close proximity to major highways and are more likely to breathe polluted air, and have higher rates of asthma and cardiovascular disease. People of color in the city, who are also likely to be lower-income as a result of historical marginalization and segregation, are more likely to be victims of car crashes. Climate action, implemented with an equity lens, can reduce many of these negative impacts of past decisions that have disproportionately impacted marginalized communities.

An auto-centric transportation system is a financial burden, especially for lower-income residents; the average cost of car ownership in Ramsey County adds around $9,500 a year to the household budget. Those who do not own a vehicle often pay for auto-centric infrastructure that they do not use. For example, the hidden cost of parking is often reflected in higher rents and higher costs for goods and services. This disproportionately impacts low-income residents who have limited or no access to a personal vehicle. Approximately 14% of driving-age city residents have no access to a vehicle.

Decreasing carbon emissions in the transportation sector requires a concerted set of policies that focus on simultaneously electrifying the transportation system, while reducing driving demand and increasing mode share (the percentage of commuters using a particular mode of transport) of public transit and active transportation (any human-powered mode of transportation).

Saint Paul has made significant strides toward increasing public transit and active transportation usage. The opening of the eleven-mile Green Line light rail system in 2014 connected the central business districts of Saint Paul and Minneapolis. Twenty-seven miles of new biking infrastructure have also been added since 2015. Biking in the Twin Cities has gone up by 13% since 2000, and driving has been reduced by 6%.

Saint Paul has developed far-reaching plans that will influence transportation and land-use decision making in the coming years. In 2019, the city approved its updated Comprehensive Plan that will guide the city's development for the next twenty years. The plan calls for improving the transportation options available to residents, substantially increasing the number of new transit oriented developments, and providing high quality sidewalks throughout the city, so that by 2040 every resident has true transportation choice. The city has also released versions of transit, bicycle, and pedestrian plans as addendums to the Comprehensive Plan that seek to increase transit frequency and reliability and make walking and biking easy, safe, and comfortable throughout the city.



Map 11. Percentile of exposure to poor air quality (based on national data) from traffic particulate matter emissions. Data collected from USEPA tool EJSCREEN and based on proximity to varying traffic volumes.

Transportation and Mobility Priorities

Reducing emissions from the transportation sector will require a concerted set of actions that must be implemented simultaneously—focused primarily around electrifying the transportation system and reducing the number of vehicles miles traveled (VMT) in the city. The priorities recommended in this plan were developed around a number of guiding themes:

- Increase safe and reliable access to city destinations without the use of a private automobile
- Mitigate the historical effects of discriminatory transportation decision-making and bring transportation equity to marginalized communities
- Commit to reducing transportation costs, particularly in communities of color and low-income communities through a range of initiatives such as providing more public transportation options and investing in safe and affordable active transportation options
- Improve public health through effective transportation and land-use decisions — reduce particulate matter emissions, increase active transportation options, and eliminate deaths and injuries from traffic crashes

Photo Credit: Great Plains Institute

WASTE MANAGEMENT

Photo Credit: Great Plains Institute

Waste accounts for approximately 4% of total greenhouse gas (GHG) emissions in Saint Paul. These emissions are largely attributed to the Newport Resource Recovery facility, where waste produced by businesses in Ramsey and Washington Counties is delivered and used as fuel to produce electricity. Emissions associated with waste can largely be reduced through reducing and diverting waste from land fills and incinerators. The City of Saint Paul, through Resolution 14-519, established goals of diverting waste 40% by 2020 and 80% by 2030. The city has already taken steps to work toward achieving these goals. Through organized trash collection, the city is better able to track waste generation and to target education and outreach efforts to increase waste reduction and recycling.

Saint Paul contracts with haulers to provide recycling and garbage services to residential households. Recycling is collected for all residential households, from single family through large apartment buildings. Garbage is collected through an organized trash collection system for all residential properties up to four units. For all other residential and commercial properties, trash is collected through an 'open hauling' system. In addition to residential collection, the city also offers a drop-off site for recyclable materials and drop-off events for recycling and proper disposal of larger items that are not collected through the residential collection program, such as appliances, electronics, scrap metal, mattresses, and construction debris. The city supports and promotes organics recycling opportunities at the Ramsey County Yard Waste sites and additional drop off locations. It also promotes the Ramsey County Household Hazardous Waste drop-off facility for proper disposal of toxic and hazardous items.

The Ramsey County Solid Waste Management Master Plan provides the blueprint for the solid waste system for communities under its jurisdiction. Ramsey County incorporates the State's waste management hierarchy, which emphasizes waste diversion through a prioritization of waste reduction/reuse and recycling/composting over energy recovery and disposal. The County is an important partner that can help Saint Paul achieve our waste goals by providing support through policy development, financial assistance, regulation, education and outreach, and direct services.

Waste Priorities

- Follow the State's waste hierarchy with particular attention to the prevention of waste generation
- Ensure that environmental justice is included in decision-making and program implementation
- Continue education and outreach in partnership with Ramsey County to increase recycling rates in historically low participation neighborhoods
- Demonstrate leadership at the city level in operations and at events
- Coordinate with Ramsey County to properly manage and dispose of debris that results from emergency situations

WATER CONSERVATION AND WATER QUALITY

Water, especially the Mississippi Riverway, holds historical and cultural significance, including homeland and sacred sites of the Dakota. Through the Great River Passage Initiative, the city is working with community partners to protect and enhance the vibrancy and accessibility of the Saint Paul riverfront. When considering resilience strategies that address water conservation and quality, the city should be intentional about incorporating the efforts of this initiative and inclusive of cultural values.

Saint Paul has more shoreline along the Mississippi River than any other city in the country, and this mighty river provides Saint Paul with most of its drinking water. Similarly, Saint Paul is home to beautiful creeks, lakes, and wetlands that support urban wildlife. Rainwater travelling across pavement during heavy rainfalls picks up trash, leaves, animal waste, and chemicals from lawns and cars. If these items reach the river and other water bodies through storm drains, they will pollute the water. Efforts to prevent polluted waterways must include steps taken during heavy rain events, which are occurring with greater intensity and frequency due to climate change. Keeping rainwater where it falls or slowing its path to lakes and rivers helps to reduce the load on storm sewer capacity and gives ecological systems a chance to filter out harmful chemicals.

The city has found that managing stormwater through shared, stacked green infrastructure efficiently leads to cleaner water resources and creates vibrant places where people love to live and visit. Shared stormwater management includes green infrastructure (e.g., rain gardens) that serve more than one parcel at a time. A stacked system does more than manage stormwater. For instance, the system may provide irrigation for plants and trees or serve as a park-like amenity by incorporating vegetation and greenspace elements. Through better, more integrated stormwater management, the city can become cleaner, healthier, and more resilient.

Water Priorities

- Preserve safe, quality drinking water sources and distribution systems for the city
- Promote a culture of water conservation
- Foster environmental stewardship, engage the community, ensure protections of sacred and significant sites, and heal compromised landscapes

Photo Credit: Great Plains Institute

EMISSIONS REDUCTION GOAL: EQUITY, EFFICIENCY, & ELECTRICITY

The City of Saint Paul has a goal to achieve carbon neutrality by 2050 and cut emissions in half by 2030, compared to business-as-usual (BAU). Xcel Energy has committed to delivering carbon-free electricity by 2050, which will decrease community-wide emissions 39% relative to the BAU scenario. This reduction allows Saint Paul to focus efforts more directly on reducing emissions from travel and natural gas, and on improving equitable access to clean electricity. To achieve our goals, the city will need to realize an average annual emissions reduction of 3% across natural gas and travel emissions.

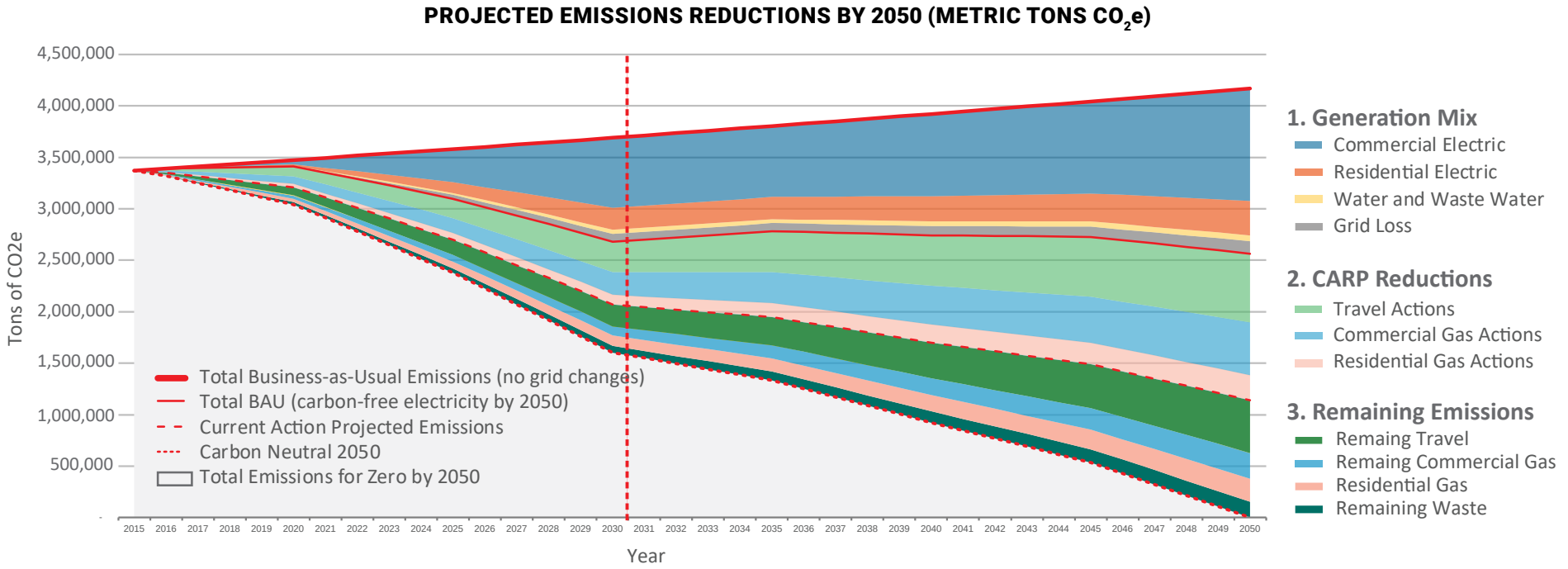


Figure 8: Projected and planned emissions reductions from Business-as-usual scenario. Data sources: Xcel Energy natural gas and electricity use (2015), Minnesota Department of Transportation vehicle miles traveled (2015)

The targets and initiatives identified in this plan and emissions reductions from electricity generation would result in approximately a 73% reduction from BAU in 2050, or a 66% emissions reduction from 2015 levels. By 2030, emissions would be reduced 44% from BAU, falling short of the 50% reduction goal. The projected emissions reductions graph above includes reductions from (1) Xcel Energy's 2050 carbon-free generation mix, (2) reductions from the actions included in the plan, and (3) remaining emissions. The emissions that remain primarily come from natural gas use in buildings, and gasoline and diesel used in vehicles. To achieve carbon neutrality, the city will need to implement more advanced actions to replace remaining fossil fuel use through electrification, dramatic shifts in land use, and thermal grid technologies (such as efficiency, waste heat capture, and renewable energy sources applied to the heating and cooling system).

Buildings

Attaining carbon neutrality in just over 30 years will require aggressive efforts to reduce overall building energy use 50% through efficiency and conservation and convert energy sources to renewable or carbon-free energy. The scale of the effort will also depend on how Saint Paul's underlying energy needs are changing.

Under a business-as-usual scenario of 1.1% growth in annual energy use, carbon emissions would increase 50% by the year 2050 if nothing else changed. However, Xcel Energy's current Upper Midwest Resource Plan forecasts significant electricity decarbonization between now and 2030 and has committed to carbon-free electricity by 2050. The 2030 reductions alone would get Saint Paul buildings nearly 40% of the way toward carbon neutrality, significantly freeing up city resources to achieve additional emissions reductions.

Saint Paul's near-term priorities reflect sectors or activities that will have high impact and where the city can begin implementing strategies over the next one to three years. While implementation can begin immediately, the incremental impact of these strategies is expected to be realized over at least a 10-year time horizon. However, these priority areas do not account for the full energy footprint across all city sectors, and therefore are not inclusive of all efforts that will need to be put in place to achieve carbon neutrality. These priorities were selected because they offered the highest likelihood of early success, reflected necessary foundational groundwork for later stated strategies, or addressed issues that needed significant lead times to get off the ground.

Photo Credit: Great Plains Institute

RESIDENTIAL TARGETS AND ACTIONS

Residential energy accounts for 19% of Saint Paul's community-wide emissions. Because Xcel Energy plans to produce 100% carbon-free electricity by 2050, the emissions from residential buildings at that time will come entirely from natural gas consumption for the purposes of space and water heating, as well as cooking. The most impactful actions to reduce those remaining emissions will be:

1. **Prevent emissions with the adoption of stricter building energy codes for new development**
2. **Complete deep energy retrofits that include building envelope improvements**
3. **Encourage electrification of natural gas appliances**

An inventory of actions to improve efficiency and expand renewable energy is included in the PiE plan. This page includes targets and additional initiatives the city should implement to achieve our goals.

Inspire a Culture of Energy Stewardship	Residential Targets	2030 Targets	2040 Targets	2050 Targets
Inspire a culture shift that transforms the community's relationship to energy use, tripling the incremental savings from conservation and renewable energy adoption within 10 years.	Annual household participation in deep energy conservation programs	1,200/yr	3,500/yr	2,500/yr
	Annual increase in household participation in WindSource® or Renewable*Connect® (50% participation by 2030)	3,850/yr	1,000/yr	1,000/yr
	Residential solar rooftop capacity (MW) equal to 10% of electric consumption by 2030, 1 MW/year after 2030	50 MW total	60 MW total	70 MW total
	Percent of new housing designed and constructed to green building standards (accelerate, if possible)	25%	50%	100%

Key Initiatives:

R-1 Achieve PiE plan Year 1 milestones related to energy efficiency

R-2 Work at the state level to support green residential building energy standards; adopt the stretch building code when it becomes available

R-3 Create a comprehensive deep energy efficiency retrofit program that systematically reaches every 1-4 unit household in the city, beginning simultaneously in high energy use and low-income neighborhoods

R-4 Educate residents about the benefits of replacing heating equipment with air-source heat-pumps, or other efficient electric heating options

R-5 Support opportunities for residents to replace natural gas appliances (e.g., ranges, water heaters, etc.) with electric alternatives; partner with Xcel Energy to explore thermal storage opportunities

R-6 Identify opportunities for thermal grid applications for new developments

R-7 Host a citywide solar resource map on the city website

R-8 Offer a production incentive for residential solar installations

RESIDENTIAL ENERGY BURDEN

An estimated 38,000 Saint Paul Households live below 50% of the area median income. A baseline analysis of household income and average energy costs show that 12 census tracts within the city have a median energy burden above 4%, with the highest at 12%. These 12 tracts contain over 10,000 households. The following initiatives are aimed at relieving energy burden among households in the 12 census tracts identified in the PiE plan.

Reduce Resident Energy Burden	Residential Targets	2030 Targets	2040 Targets	2050 Targets
Lower the energy burden so that no Saint Paul household spends more than 4% of household income on energy costs.	Annual household participation in low-income deep energy conservation programs	1,600/yr	1,600/yr	500/yr
	Annual household participation in low-income community renewable energy programs	1,000/yr	1,000/yr	1,000/yr
	Percent of new affordable development designed and constructed to green building standards	100%	100%	100%

Key Initiatives:

REB-1 Establish an energy burden working group to coordinate outreach actions and resource knowledge among local community entities and trusted leaders

REB-2 Develop policy options that incentivize 4D property owners (a classification of properties that receives reduced property tax rates to maintain affordability) to make energy efficiency improvements

REB-3 Help increase low-income access to affordable renewable energy

REB-4 Host community-solar gardens that include low-income participation

REB-5 Offer a higher production incentive to income-qualified households as compared to other households

Existing Residential Programs and Resources

- Home Energy Squad
- Weatherization Assistance Program
- Energy Smart Homes
- WindSource®
- Renewable*Connect®
- Community solar gardens
- Bulk purchase programs: Solar United Neighbors, Solar Power Hour
- Energy Sage Solar Calculator
- Residential Renewable Energy Federal Investment Tax Credit
- Xcel Energy Solar*Rewards
- Minneapolis 4D Housing Incentive
- Inspiring Communities
- Solar*Rewards for income-qualified customers
- Minneapolis Green Cost-Share

Photo Credit: Great Plains Institute

MAJOR INSTITUTIONS TARGETS AND ACTIONS

The commercial and industrial sectors make up the greatest share of building emissions. Achieving significant reductions among the city's largest buildings will be critical to work toward carbon neutrality. Many companies across the country are setting their own greenhouse gas (GHG) reduction goals. By working closely with the largest users in the commercial sector, both the city and the business community can realize the benefits of reducing energy use and GHG emissions. The most impactful actions in the commercial sectors are:

1. **Green building standards for new buildings**
2. **Efficient operation of existing buildings**
3. **Building energy retrofits**

Engage Major Institutions on Climate Leadership	Institutional Targets	2030 Targets	2040 Targets	2050 Targets
Within 3 years, win commitments of major institutions to achieve carbon neutrality by 2050 and ensure 80% of institutional buildings are actively benchmarked, and within 10 years, help institutions realize a 35% total GHG reduction, with energy efficiency as the leading strategy.	Participation of institutional buildings in energy benchmarking program	100%	100%	100%

Key Initiatives:

MI-1 Secure institutional commitments to achieve carbon neutrality by 2050 in the next two years; following the leadership of Macalester College (carbon neutral by 2025) and University of St. Thomas (carbon neutral by 2035); involve student leaders

MI-2 Explore feasibility and impact of energy benchmarking requirement

MI-3 Support institutions in assessing readiness for renewable energy and investing in renewable subscriptions and/or local renewable installations.

MI-4 Implement additional outreach with local partners to increase participation in available programmatic financing options

MI-5 Implement an energy challenge competition to motivate institutional partners

Photo Credit: Great Plains Institute

MULTIFAMILY AND LARGE COMMERCIAL

Multifamily and large commercial are the next largest users of building energy. Of the more than 100,000 housing units in Saint Paul, approximately one-third are multifamily (5+ units). Other buildings classified as commercial properties include a wide range of use types. Of those over 25,000 square feet, the largest use category are properties classified as generic commercial, such as offices and retail. The different use types pose a range of challenges in addressing energy consumption and program delivery. Better building management and increased energy awareness can help minimize many of those challenges.

Engage the Multifamily and Large Commercial Sector	Multifamily and Large Commercial Targets	2030 Targets	2040 Targets	2050 Targets
Adopt multifamily and large commercial sector conservation and renewable initiatives that result in an additional 4% annual reduction in GHG emissions.	Participation in building energy benchmarking (50k sq. ft.)	100%	100%	100%
	Percent of new development designed and constructed to green building standards	10%	100%	100%
	Commercial solar rooftop capacity (MW)	100 MW total	130 MW total	160 MW total

Key Initiatives:

LC-1 Ensure the former Ford site becomes a leader for sustainable planning with locally generated power from an integrated, renewable site-based energy system

LC-2 Explore feasibility and impact of an energy benchmarking requirement

LC-3 Update and expand Saint Paul's Sustainable Building Policy to strengthen requirements

LC-4 Enhance the expertise of building operators and code officials to optimize efficient building performance

LC-5 Prepare and disseminate resources for the commercial sector on financial benefits of solar installations

LC-6 Offer a production incentive for commercial solar installations

LC-7 Explore opportunities for renewable natural gas (biomethane) with low-carbon feedstock

LC-8 Assess feasibility to expand thermal grid strategies (e.g., district heating)

LC-9 Pursue and consider policies to incentivize advanced heat recovery projects

LC-10 Identify where strategic electrification of certain loads would assist in decarbonization

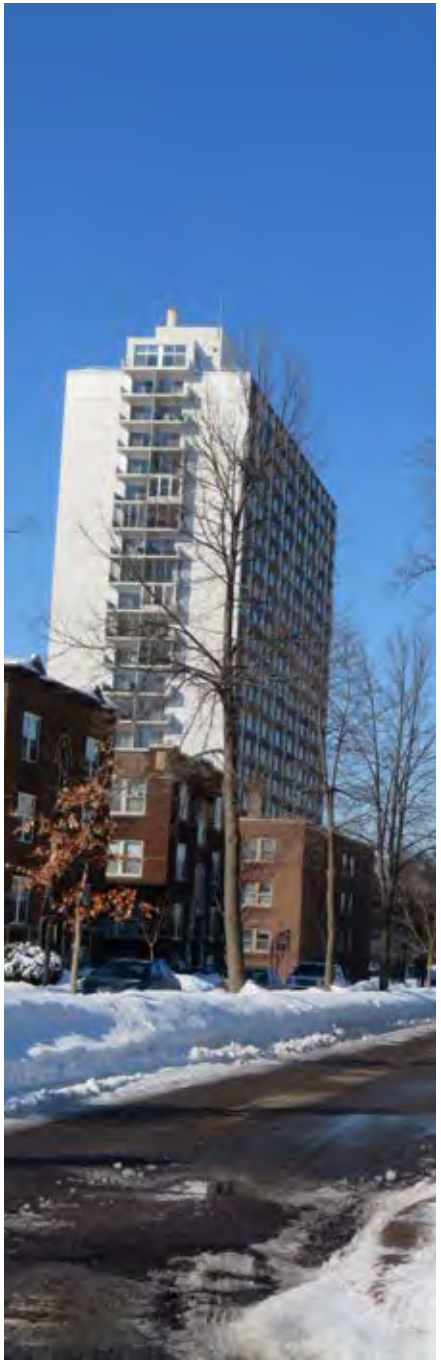


Photo Credit: Great Plains Institute

SMALL AND MID-SIZE COMMERCIAL

Small and mid-size businesses often operate on budgets with thin margins. Making energy improvements can help decrease unnecessary costs and improve comfort.

Engage the Small & mid-size Commercial Sector	Small & mid-size Commercial Targets	2030 Targets	2040 Targets	2050 Targets
Reduce energy consumption and GHG emissions in small and mid-size businesses.	Annual participation in energy conservation programs	5%/year	5%/yr	5%/yr
	Annual participation in green power purchase program	2.5%/yr	2.5%/yr	2.5%/yr
	Commercial solar rooftop capacity (MW)	50 MW total	60 MW total	70 MW total

Key Initiatives:

SC-1 Engage small businesses in energy efficiency programs

SC-2 Target small businesses in low-income communities with energy efficiency opportunities

SC-3 Promote financing and rebate opportunities, such as commercial PACE and utility rebate programs

SC-4 Provide information for small business efficiency programs in multiple languages

SC-5 Promote utility green power purchase programs

SC-6 Provide information and resources for participating in a community solar garden project

SC-7 Offer a production incentive for commercial solar installations

Existing Multifamily and Large Commercial Programs and Resources:

- Sustainable Growth Coalition
- Energize Saint Paul
- WindSource®
- Renewable*Connect®
- Community solar gardens
- Race to Reduce
- Commercial PACE
- Energy Efficiency Programs

Photo Credit: Great Plains Institute

Transportation Emissions

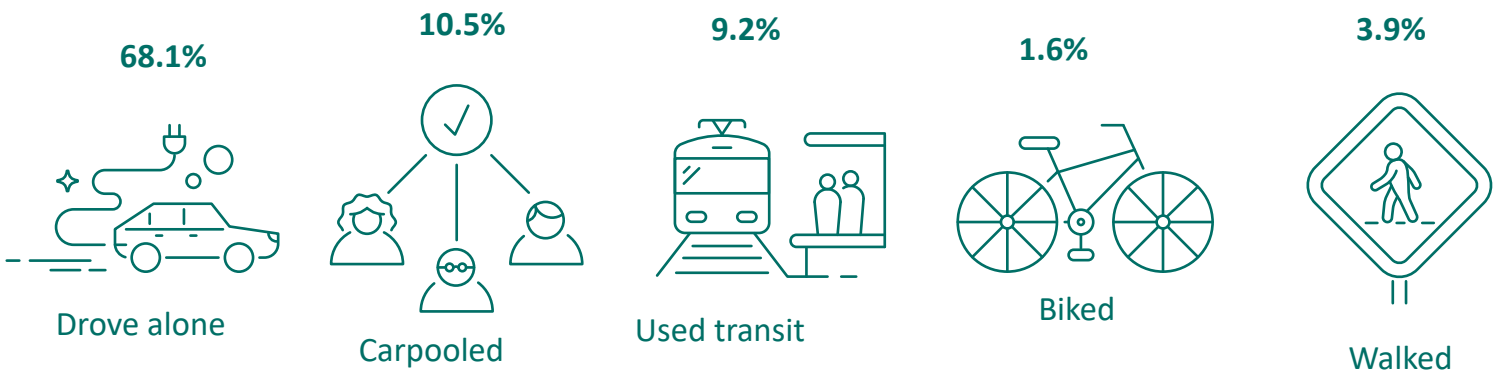
Transportation is responsible for approximately 31% of all emissions in Saint Paul. The majority of emissions come from on-road vehicles including light-duty passenger vehicles and heavy-duty vehicles. Of these vehicles types, 71.5% are passenger vehicles and 27.9% are heavy-duty vehicles, which often use diesel as the primary fuel. Additional in-boundary transportation emissions come from rail and boats, though these make a small percentage of travel emissions.

In 2017, the majority of commuters traveled in single-occupancy vehicles (68.1%). Just over 10% carpooled. Together, transit, biking, and walking made up about 15% of commuters, and 5.6% of residents worked from home. There is opportunity to continue to shift people from personal vehicles to other modes of transit. As technologies and services change, there are more options than ever for people to move around the city.

This plan focuses on reducing emissions first by making cleaner modes of transportation the easy option. Reducing the amount of vehicle miles driven is critical to achieving carbon emission reduction goals. Providing safe and easy access to walking, rolling (e.g., using scooters, skateboards, rollerblades, wheelchairs, etc.) , and biking has the added benefit of promoting better health.

In addition to reducing vehicle miles traveled through mode shift, this plan also recognizes that there are times when people are going to need cars. Electric vehicles offer cleaner alternatives to internal combustion engines both in terms of GHG emissions and local air pollution. By enabling accelerated adoption of electric vehicles through charging infrastructure build-out, the city can help move toward a more sustainable transportation future. As much as possible, the city is focused on the electrification of car-sharing services to better support those who do not own a car.

2017 Commuting Characteristics



Source: 2017 American Community Survey 5-year Estimates

Photo Credit: Great Plains Institute

Transportation and Mobility

SINGLE-OCCUPANCY VEHICLES

The majority of trips taken in Saint Paul are people driving alone in their vehicles, often for distances less than one mile. No- and low- carbon transportation modes, like biking, public transit, rideshare, using a scooter, and walking, all minimize emissions compared with single passenger vehicles. They also offer co-benefits like reducing traffic congestion, improving mental health and well-being, and minimizing cost to the individual. Providing residents with easy alternatives can help reduce the number of people who drive alone and reduce the per-person vehicle miles driven each year.

Reduce Single Occupancy Vehicle (SOV) travel demand	Land use and Travel Management Targets	2030 Targets	2040 Targets	2050 Targets
The City of Saint Paul will prioritize walking, biking, rolling and taking public transit for travel and reduce driving by 40% by 2040.	% Reduction of SOV commuters (from 2015 levels)	-10%	-40%	-50%
	% Reduction of per person vehicle miles travelled (VMT) annually	-2.5%/yr	-2.5%/yr	-2.5%/yr

Key Initiatives:

TM-1 Reduce or eliminate citywide minimum parking requirements and set parking maximums for most land-use types and require developers and landlords to "unbundle" parking from rent

TM-2 Redesign parking fees to capture the full cost of parking in downtown and other high-demand commercial districts

TM-3 Provide a stable funding source to implement the recommendations of the city's Comprehensive Plan

TM-4 Bring together various stakeholders including the city, transit agencies, and community groups to create affordable housing in the transit market areas defined by the Metropolitan Council

TM-5 Implement pricing strategies that accurately capture the cost of driving and auto-centric infrastructure on city roads

TM-6 Identify strategies to mitigate the impacts of inner-city highways including capping, conversion to boulevards, or complete removal

TM-7 Incentivize infill development by implementing smart growth strategies described in the city's draft Comprehensive Plan

TM-8 Increase the number of communities that are mixed-use and higher-density

TM-9 Implement the "Vision Zero" program recommendation of the Comprehensive Plan to achieve zero traffic fatalities on city rights-of-way

Photo Credit: Great Plains Institute

TRANSIT RIDERSHIP

There are many transit options for Saint Paul residents, including light rail, bus rapid transit (BRT), express buses, and local bus lines. However not all parts of the city are serviced equally with transit options – and as transit ridership increases, we must ensure that deployment of transit options is equitable. For those who take transit, the Metropolitan Council offers GoTo Cards and has a mobile application so that riders do not need to carry cash for fares. Likewise, some employers subsidize transit ridership if used as the primary method of commuting.

Increase Transit Ridership	Transit Targets	2030 Targets	2040 Targets	2050 Targets
Increase transit availability, frequency and reliability to ensure parity with automobile travel times, focusing on the transit market areas defined by Metropolitan Council.	Increase mode share of transit from 2015 levels	6% increase in ridership	25% increase in ridership	40% increase in ridership

Key Initiatives:

TR-1 Ensure shared mobility options are located within .25-mile of transit service to increase options for the first and last mile

TR-2 Work with city, state, regional and federal stakeholders to identify long-term sustainable funding strategies to complete the planned build-out of transit lines

TR-3 Create high-frequency rapid transit in all parts of the transit market areas defined by Metropolitan Council

TR-4 Increase transit coverage in concentrated areas of poverty to increase access to jobs and destinations in the downtown core; ensure mobility options remain public and accessible

TR-5 Support transit with last mile solutions including electric car-share, standard or e-bike share, and scooters that will become more broadly available at mobility charging hubs

TR-6 Streamline services to prevent redundancy and enable passengers to easily understand routes and schedules

TR-7 Strategically place stops to improve transit speed and reliability

TR-8 Upgrade and refurbish highly used transit stops to include amenities such as benches, shelters, trash cans, way finding signs and lighting

TR-9 Relocate stops that feel unsafe or are placed near high-speed vehicle traffic

TR-10 Invest in all-door boarding and off-board fare payment

TR-11 Improve accessibility at transit stops for those in wheelchairs or with limited mobility. Continue to add ADA-compliant pads, and prioritize improvements in neighborhoods experiencing poverty

TR-12 Create a framework where ride-hailing services reduce overall trips by combining them with other tools such as walking, biking, transit, shared rides, and compact development

Photo Credit: Great Plains Institute

LAND USE AND MOBILITY

Ensuring that transportation alternatives are feasible and safe for Saint Paul residents is crucial to see changes in the ways that people move around the city. The presence and maintenance of the mobility infrastructure like bicycle lanes and curb cuts for all types of wheels and walkers can help improve user experience.

Enable and increase in biking and walking	Alternative Modes Targets	2030 Targets	2040 Targets	2050 Targets
Ensure that 85% of Saint Paul residents have safe access to protected active transportation facilities.	Miles of bike/rolling infrastructure	85 miles of new bikeway constructed	195 miles of new bikeway constructed	300 miles of new bikeway constructed
	Walking infrastructure	150 miles of sidewalk gaps closed	327 miles of sidewalk gaps closed	All sidewalk gaps are closed

Key Initiatives:

LM-1 Accelerate the build-out of the full bicycle network planned in the Saint Paul Bicycle Plan to add a total of 195 miles of new bikeways; update the plan to reflect best practices prioritizing protected bicycle facilities over unprotected or shared lanes

LM-2 Invest in driver education programs to improve the visibility and acceptance of those walking and biking on city streets and enhance safety

LM-3 Outline clear policies for electric bikes, skateboards, and scooters on city bike lanes, paths, and trails

LM-4 Implement a road diet on all four-lane city streets

LM-5 Incorporate accessibility options for wheelchairs and other mobility devices in build-out of protected lanes

LM-6 Enable the ubiquitous availability of shared bicycles in all the transit market areas defined by the Metropolitan Council

LM-7 Work with stakeholders to incentivize bike usage by providing bike-share memberships and increase the availability of bike showers and lockers

LM-8 Improve bicycle access and parking at transit stations and stops and expand the number of transit routes that allow bikes to be brought on board

LM-9 Redesign roads to be safer for people by narrowing streets through four-to-three lane conversions, reduced street widths, curb extensions, and refuge medians

LM-10 Dedicate annual funding for the Bicycle, Pedestrian, and Traffic Safety Fund to move toward relative parity with investments in vehicle infrastructure

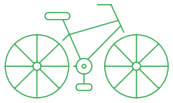
LM-11 Complete filling in the 327 miles of sidewalk gaps in the city, focusing on the high-priority areas defined in the city's Pedestrian Plan

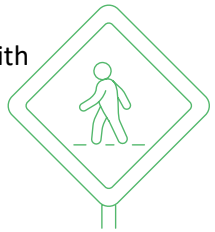
LM-12 Prioritize safe walking to transit stops. Ensure that pedestrian facilities near transit stops feel safe, comfortable and are accessible

LM-13 Continue to support and fund the Saint Paul Safe Routes to School Policy Plan to ensure the safety of children walking to school; work with students to help plan routes

LM-14 Invest in street crossing treatments that highlight pedestrian visibility and slow drivers

LM-15 Invest in proactive sidewalk inspections after heavy snowfalls and provide city resources to clear snow where needed





VEHICLE ELECTRIFICATION

The cost of an electric vehicle (EV) continues to become more affordable. In order to enable wider adoption of electric vehicles, there needs to be investment in charging infrastructure (EVSE). Providing and prioritizing electric car-share hubs, allows residents to access cars without having to own one.

Increase Electric Vehicle Ownership	EV Targets	2030 Targets	2040 Targets	2050 Targets
Incentivize the sales of electric vehicles and expand charging infrastructure so that 40% of vehicles on city streets are electric by 2030.	Number of Level 2 chargers deployed	364 Level 2 Chargers	600 Level 2 Chargers	As needed
	% of on-road vehicles that are EVs	33%	80%	100%
	Number of mobility charging hubs	75	100	300

Key Initiatives:

EV-1 Continue to increase access to shared electric vehicles in partnership with car-sharing services and Xcel Energy

EV-2 Expand access to public charging infrastructure

EV-3 Ensure all residents are within a quarter mile of a mobility charging hub

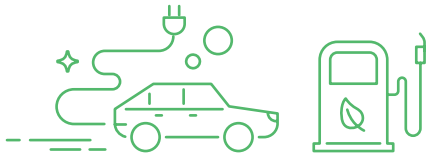
EV-4 Incentivize electric vehicle sales by providing charging at city-owned parking lots and working with employers to provide workplace charging

EV-5 Provide a regulatory framework to permit charging on residential streets in front of multifamily dwellings

EV-6 Proactively encourage the safe use of non-car electric vehicles such as e-bikes and scooters on city rights-of-way

EV-7 Implement building ordinances that require new developments to have wiring capacity to charge electric vehicles and reserve a percentage of new parking spots for exclusive EV use

EV-8 Encourage electric car-sharing programs to help familiarize residents with EVs, while reducing total driving demand. Prioritize deployment of these programs in areas with low levels of car ownership



Existing Transportation and Land Use Programs and Resources:

- City of Saint Paul Comprehensive Plan
- Parking Reform Made Easy
- City of Saint Paul, Downtown Parking Management Strategy
- Accessibility In Practice, A Guide for Transportation and Land Use Decision Making, SSTI, 2017, 2013
- Metropolitan Council Transportation Policy Plan
- Saint Paul Bicycle Plan
- Safe Routes to School Plan
- Saint Paul Bike Equity Report
- 2017 Pedestrian and Bike Count Report
- City of Saint Paul Capital City Bikeway: Network Study and Design Guide
- Preliminary Saint Paul Pedestrian Plan
- Plugging In: Readying America's Cities for the Arrival of Electric Vehicles, Frontier Group
- Existing charging stations, City of Saint Paul
- East Metro Strong Transit Study (upcoming)
- Arterial Bus Rapid Transit Plans (upcoming)

WASTE REDUCTION TARGETS AND ACTIONS

The waste targets are aligned with Ramsey County waste goals.

Reduce waste generation	Waste reduction targets	2030 Targets	2040 Targets	2050 Targets
The City of Saint Paul, through Resolution 14-519, established goals of diverting waste 40% by 2020 and 80% by 2030. Saint Paul contracts with haulers to provide recycling and garbage services to residential households.	Total waste diverted from landfill or resources recovery.	80%	90%	100%
	% reduction of annual tons	-2%/yr	-5%/yr	-5%/yr
	% of waste stream composted	5%	10%	15%
	% of waste stream recycled	50%	55%	60%

Key Initiatives:

WR-1 Develop and implement a waste prevention plan to keep items out of the trash

WR-2 Develop and adopt an ordinance to place a fee on single-use shopping bags

WR-3 Promote county compost and yard waste drop off sites

WR-4 Develop and implement a household organics collection program

WR-5 Expand recycling for businesses and public facilities

WR-6 Adopt a deconstruction/diversion ordinance to require the reuse/recycling of construction materials

WR-7 Adopt a "to go" packaging ordinance requiring containers to be recyclable or compostable

WR-8 Coordinate with Ramsey and Washington County to support anaerobic digestion of organic materials, or other GHG reducing practices

WR-9 Work with the Minnesota Pollution Control Agency (MPCA) to identify opportunities to capture and utilize any methane leaking from closed Pig's Eye landfill

WR-10 In consideration of the Great River Passage, coordinate with the MPCA and community stakeholders to explore land use strategies that can benefit residents and improve the environmental aspects of the Pig's Eye Landfill, such as a ballasted community solar garden

Existing Waste Programs and Resources:

- 2019 Annual Guide

WATER AND WASTEWATER TARGETS AND ACTION

Water is a critical asset to the city. Maintaining a stable water supply is important to ensure a sustainable source for years to come. The amount of water that is treated and distributed also has an impact on the city's greenhouse gas emissions as there is significant electricity used in this process. Water conservation measures will help reduce GHG emissions and ensure the capacity of the system is adequate to meet future needs.

Reduce water consumption	Water reduction Targets	2030 Targets	2040 Targets	2050 Targets
Water conservation helps to save money, reduce energy use, and reduce the use of a valuable resource.	% Reduction in per/person annual water consumption	-2%/yr	-2%/yr	-5%/yr
	% Reduction in per/job annual water consumption	-5%/yr	-5%/yr	-5%/yr

Key Actions:

WW-1 Create greater awareness and adoption of water conservation measures through educational and promotional material

WW-2 Include low-flow shower head use as part of energy efficiency outreach programs

WW-3 Encourage replacing water-intensive turf with native plants at homes, office spaces, and other under-utilized outdoor spaces

WW-4 Identify and support opportunities for residents and small businesses to electrify water heaters and use as thermal storage

WW-5 Identify opportunities for businesses with significant hot water loads (laundromats and hospitals) to install solar thermal technology

Photo Credit: Great Plains Institute

CITY OPERATIONS AND MUNICIPAL LEADERSHIP

A focus on municipal buildings lets the city lead by example and demonstrate a commitment to climate leadership first within its own operations. Saint Paul has already invested in energy efficiency within several of its buildings. The municipal focus area will include continued emissions reductions in buildings, vehicle fleet, and street lighting.

Inspire through Municipal Leadership	Municipal Targets	2019-2025 Targets	2025-2030 Targets
Achieve carbon neutrality in municipal operations by 2030.	Annual GHG reductions	-9%/yr	-9%/yr
	Annual renewable energy generation	10%/yr	15%/yr
	Annual fleet emissions reductions	-9%/yr	-9%/yr

Key Actions:

CO-1 Track and organize all city electric and natural gas meters in a benchmarking program (e.g., B3). Identify poor performers and manage energy data. Look for opportunities to automate data management and building controls to improve the outcomes and reduce staff time

CO-2 Accelerate the existing goal for city buildings to be carbon neutral from 2030 to 2025.

CO-3 Increase the city's internal revolving loan fund to $10 million

CO-4 Convert municipal streetlights to LEDs. Explore other opportunities to for smart lighting

CO-5 Identify opportunities to deploy renewable thermal technologies (district heating, solar thermal, etc.)

CO-6 Increase municipal purchases and installations of renewable energy. Prioritize opportunities that will result in a net cost-savings to the city, including on-site solar or community solar gardens

CO-7 Work with eligible schools to participate in Xcel Energy's low-income solar opportunities; ensure an educational component and student involvement

CO-8 Assess the city's vehicle fleet to identify opportunities for electrifying, right-sizing, and improving overall efficiency of vehicles; install electric vehicle charging infrastructure in municipally-owned parking lots

CO-9 Identify opportunities to convert heavy-duty vehicles to alternative fuels that reduce carbon emissions

CO-10 Work with state and regional partners (state, MnSCU, Metropolitan Council, cities) to develop a robust workforce development program that includes recruitment and training of building energy workers and provides opportunity to grow equity while reaching the city's GHG targets

CO-11 Encourage employees to reduce single-occupancy commuting practices through incentives and workplace amenities (bike racks, showers, etc.)

Existing Municipal Leadership Programs and Resources:

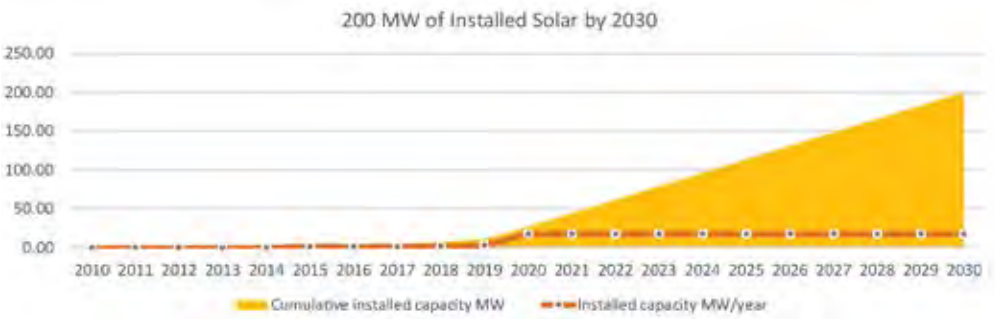
- City efficiency revolving loan fund
- B3 Benchmarking
- Guaranteed Energy Savings Program
- Office of Enterprise Sustainability

By 2030...

By 2030, the actions in this plan, along with changes to the electric grid, will result in a 44% reduction in emissions from a business-as-usual scenario. While this falls short of the 50% reduction goal, it will nonetheless have major impacts on the city's emissions. To achieve a 50% reduction, the city will need to be more aggressive in reducing emissions from vehicle travel and natural gas consumption. This means taking bolder action to curb the use of single-occupancy internal combustion vehicles, and accelerate alternatives to natural gas. To achieve accelerated results, the city can't just limit fossil-fuel dependent activities, it must provide better, heathier, and more convenient alternatives to make the choice easy for residents and businesses. Achieving targets by 2030 will set the city on a path to be carbon neutral by 2050.

SOLAR

200 MW of solar will be installed on rooftops across the city, supporting hundreds of jobs and reducing electricity consumption by 10%.



TREES

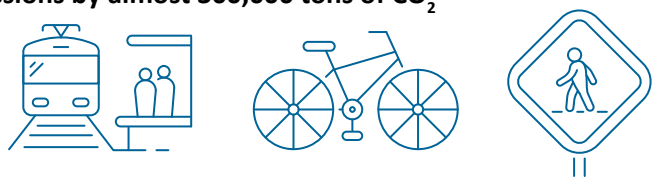
The urban tree canopy will increase from 32.5% to 40%, reducing urban heat island effect and absorbing carbon.

EFFICIENCY

19,000 homes will have deep efficiency improvements, reducing 100,000 tons of CO_2, and lessening the energy burden on those who live there. Commercial buildings will have demonstrated deep energy savings that reduce emissions by 250,000 tons of CO_2.

TRAVEL

With more transit and active mobility options available, fewer people will be driving single-occupancy vehicles, reducing emissions by almost 300,000 tons of CO_2



PLAN IMPLEMENTATION

Implementing the Climate Action and Resilience Plan requires internal and external capacity, tracking and reporting progress, financing and funding mechanisms, and creating and executing an annual work plan. The following outlines the components the city needs to put into place to successfully execute the Climate Action and Resilience Plan.

Internal Capacity

Internal capacity includes building knowledge among staff across all city departments to ensure the Climate Action and Resilience Plan is integrated into all city functions and service delivery.

1. Upon plan adoption, dedicate a staff person to act as the point person to lead the coordination of plan implementation
2. Charge the designated staff lead to work with department heads to identify how each can lead Climate Action and Resilience Plan implementation in their respective areas
    - Determine meeting frequency and agenda topics to ensure the group meets regularly with purpose
    - Review department budgets and programs through a climate lens to identify opportunities to incorporate action into city operations and services
    - Develop an internal work plan with 1- to 3-year targets that address climate change; update and report progress regularly

External Capacity

Successful implementation of this plan will require the active engagement of many people and institutions. Involvement from residents and community leaders will help provide accountability and ensure implementation is rooted in community priorities. Engagement of other jurisdictions will help broaden action, reduce barriers, and accelerate emissions reductions.

1. Establish an advisory body made up of community leaders that guides the implementation of the plan, ensuring community priorities like equity, environmental justice, and workforce development are core to the development and delivery of climate policies and programs
2. Create an outreach arm of volunteers to help increase community involvement, education, and empowerment through collective action
3. Utilize recommendations from Humphrey School of Public Affairs capstone paper: Building Equity through Community Engagement, prioritizing engagement with young leaders throughout the city
4. Participate in a coalition of Minnesota cities to drive state and federal policies. Advancing policies on the state building code, transportation funding and policies, and natural gas alternatives will further enable the city to achieve its goals
5. Participate in multi-jurisdictional partnerships to advance trans-boundary climate action. Many actions require and benefit from coordination with other public jurisdictions. Increasing transit ridership will depend on actions from the State of Minnesota, Ramsey County, and the Met Council, while car-sharing programs are successful when neighboring communities are involved. Ramsey County is a crucial partner to achieve housing, waste, and resilience goals

Tracking and Measuring Progress

Setting up a process to track and measure progress early in the plan implementation will help provide transparency and accountability. Tracking progress will include both a qualitative assessment of GHG emissions as well as an inventory of projects and programs that are implemented each year.

1. Saint Paul currently uses Clear Path to complete its annual GHG inventory. This inventory is useful for sharing with international disclosure entities. The city may consider developing an internal spreadsheet to track progress.
2. GreenStep Cities Step 4 and 5 allow cities to track both community-wide and city operations emissions, as well as relevant metrics like tree canopy and water quality. The city should continue to maintain its Step 4 and 5 reporting and ranking.
3. Share progress publicly and regularly through the city's website, social media, and other communication channels. Celebrate successes, both small and large, with staff and the community to create a positive culture around climate action.

Funding Mechanisms

Implementation of this plan will require a variety of funding mechanisms and sources to be successful. Funds will need to be directed internally to support the city operations goals and toward the community to spur action. Outside funds will also be needed to complement efforts of the city. Funding options include, but are not limited to, the following:

1. Funds raised through city mechanisms: franchise fee, dedicated fee or tax increase, reallocation of existing funds such as Capital Improvement Budgets and the STAR program
2. Financing programs like Property Assessed Clean Energy, Trillion BTU, or green bonds can support private investment in efficiency and renewable energy
3. Crowd sourcing funds for specific projects
4. Foundation funding to leverage other private or public resources

Next Steps and Priorities

In the first year of plan implementation, the city should establish internal and external capacity, determine priorities through the development of a work plan, and set a budget to get started working toward emissions reductions. Transparency and building relationships early will help establish trust, provide accountability, and spur action.

LOOKING FORWARD

The need for climate action is evident. Climate change is a global issue that calls for local solutions. By leveraging the vision and leadership of Saint Paul and the passion and motivation of our residents, business owners, the faith community, non-profit organizations, and other local partners, this Climate Action and Resilience Plan outlines a suite of targets and actions to decrease emissions across every sector in the city. It also identifies ways to cultivate long-term resilience, enhance the natural infrastructure of Saint Paul, and imagines a city of the future in which the threats of a changing climate are diminished.

There are many opportunities to reimagine the future through climate action. From multifamily buildings, to transportation, to the individual Saint Paul resident – there are a multitude of strategies to reduce emissions, as well as opportunities to be involved with the city's journey to climate resilience. Many solutions proposed are multifaceted and provide co-benefits across city sectors and the community. Trees that reduce the impact of extreme heat by providing natural cooling also have positive psychological health impacts. Establishing intra-personal networks for emergency preparedness increases sense of community and fosters long-lasting social connections. Home efficiency and building improvements can reduce monthly bills while using less energy, creating fewer emissions, and generating jobs.

This document provides the foundation for implementation and a road map for transformative action. The preparation for this document assessed vulnerabilities, emissions, and highest impact strategies. Now the city is ready to take the next step and catalyze action. Implementing the recommendations outlined in this plan will set the city on a path toward climate resilience and climate change mitigation. It will also reinforce the legacy of the City of Saint Paul as a leader and innovator, undertaking a challenging issue with determination to ensure the preservation of a safe and sustainable place for everyone who lives, works, and plays here.

Achieving these objectives will demand active engagement by the entire Saint Paul community to transform the buildings where people live and work, the way people move around the city, and the goods that are consumed. This transformation must keep equity at the forefront, ensuring that as Saint Paul works toward these goals, the outcome is a better, more equitable future for all residents, current and future.

Photo Credit: Great Plains Institute, Mural Artist: Sara K. Udvig, Margaret Park