CITY OF

MINNEAPOLIS

Restorative Development Performance Assessment

YORTH group

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PREPARED FOR MWMO
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Executive Summary

With a score of -39, Minneapolis is a city that falls into the conventional space of restorative benchmarking. This means that it is a well-functioning city by conventional standards, such as measured, for example, by the high number of F500 companies headquartered here.

However, there are many externalities and liabilities, such as excessive resource use, pollution, traffic fatalities, and intergenerational poverty that produce a net-negative effect on a system scale. Economic leakages, social inequities, and environmental degradation persist, even when the economy is growing, and the quality of life is high for many.

About Restorative Development

Restorative Development charts the path towards a system of net-positive effects, where integration between resources and assets in closed-loop systems creates economic, social, and environmental benefits. In the restorative model, resources such as water, energy, food, and materials are considered assets, and so are people and communities. Every element in a restorative system is considered an asset that has the potential to be degraded, maintained, or regenerated over time.

The increasing cost of siloed systems

Like all cities, Minneapolis is built on an infrastructure optimized in silos. Water, energy, food production, and waste management are completely independent systems. Systems are centralized, linear, and support a one-time use model (which is also called the take-make-waste economy). This leaves many synergies and benefits unrealized. Similar to our physical infrastructure, economic and social infrastructures have been built in silos, with urban planning only pivoting to a more holistic approach in recent years.

Changing systems that have been put into place decades, or even a hundred years ago, is exceedingly hard. Cities have evolved to promote a certain way of life during boom years, while quietly cementing inequities that rapidly mount to the surface during down times. Intentional systemic change is not hardwired into the system, with decision-makers only getting blame for failure, but seldom credit for success.

International comparison reveals stark difference in outcomes

In the introductory chapter, the comparison between Minneapolis and Stockholm along benchmarks set by the United Nations' Sustainable Development Goals shows vastly different outcomes, even as social expenditures in Sweden and the United States are roughly the same when healthcare costs are included.

European cities have been able to advance faster and further in the sustainability space because they have a higher tax income, increased public pressure, and higher social equity amongst their residents. In the United States, fewer tax dollars, higher social inequities and increasing economic inequality means that cities are constantly spending money to avoid the worst outcomes with little left to invest in actual solutions, such as helping people graduate out of poverty and economic exclusion.

Reaching the Minneapolis 2040 goals in the face of widening inequality

While the infrastructure served its purpose in the past, it does not scale to deliver to 21st century needs, such as increased local resilience and next-generation living wage jobs. In addition, Minneapolis, like all cities, is not prepared for the advent of artificial intelligence and automation. This deep structural change is driven by the private sector, but threatens to bring economic precariousness to cities, much like the gig economy has already done.

Already, as this report establishes, the lowest-earning 30% of households are $2.8 billion short of reaching the average metro area standard of living, a gap that is likely to increase over time.

The City of Minneapolis has ambitious goals for 2040, such as the elimination of disparities, economic inclusion, and affordable housing for all. However, despite good intentions and some current and future policy changes, it is not clear what deeper structural changes will be undertaken to course-correct the city's current trajectory of high levels of inequity and economic inequality.

It is also unclear how progress can be measured in a complex system, such as a larger city, when liabilities and externalities are not clearly accounted for.

Phase 1 of this project has resulted in a comprehensive assessment of city performance across environmental, social, and economic performance areas. There is now a new definition of success and a new definition of what is possible, as well as an established baseline from which progress and change in equity can be measured.

1. Introduction

1.1 Introduction to restorative development

Why do we need a new model for growth and wellbeing?

To start, consider this thought experiment:

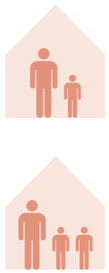
What would your neighborhood look and feel like, if the 100 people living closest to you represented the Minneapolis average?

If your 100 nearest neighbors were representative of the Minneapolis average, they would live in these 44 households:

11 married or cohabitating couples

24 Non-family households (single males and females)

7 Married couple
families with children under 18



2 Single mothers
with children under 18

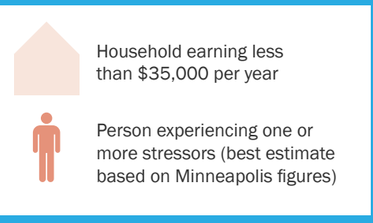
20 additional adults, including adult children and seniors, that live in any of these households.

In this neighborhood of 100 people...

- 2 of the neighborhood's 18 kids under the age of 18 experience hunger.
- 5 neighbors are victims of crime, and one is likely to experience violent crime.
- 7 neighbors do not have health insurance,
- 9 neighbors have not been in good physical health, and 11 neighbors have not have been in good mental health for 14 or more days during the past 30 days.
- 14 of the 44 households earn less than $35,000 a year.
- 27 neighbors are obese and 30 neighbors sleep less than 7 hours a night.

Assuming this neighborhood is also reflective of U.S. averages:

- 23 adult neighbors would have zero emergency savings.[1]
- 49 adults would have at least one chronic condition, and 10 adults would have at least 5 chronic conditions.[2]
- 15 households would have no retirement savings, and the remaining 29 households would have a median balance of $1100.[3]



What you saw on the previous page represents the Minneapolis average. While many of us are able to enjoy a life 'above average', we must recognize one simple truth:

In one of America's most livable cities, there are many neighborhoods where quality of life is even worse than what you just saw.

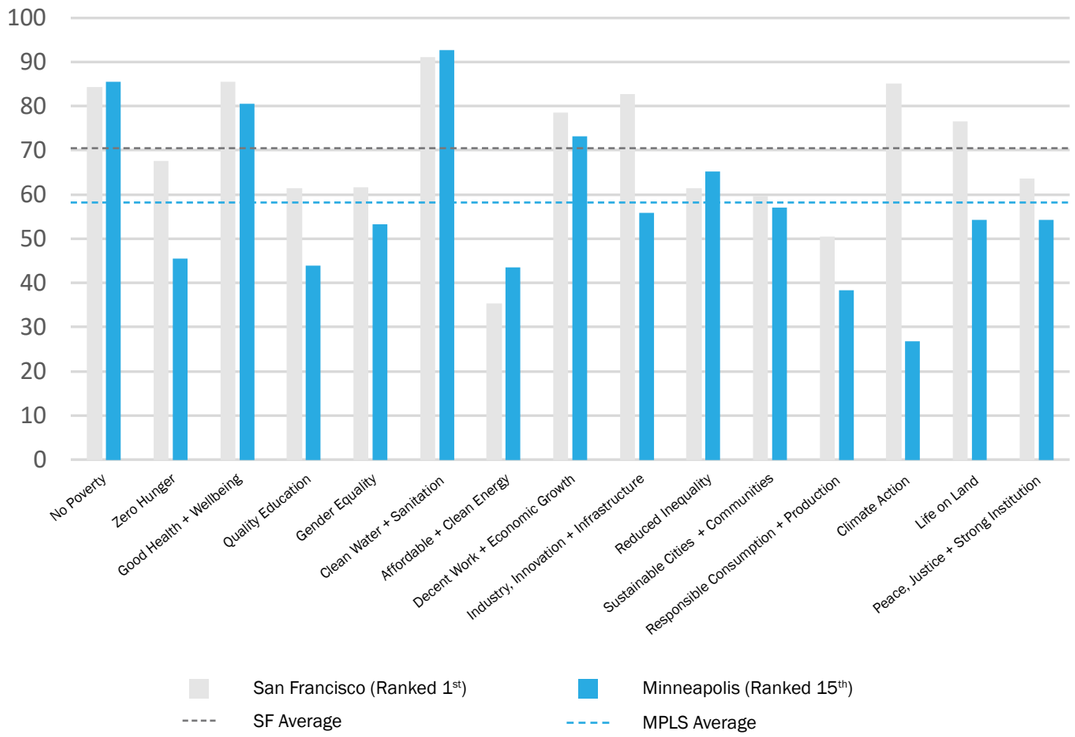
The challenges of 2020 and beyond shed a new light on our country's resilience and ability to handle crises on a societal level.

The data onour lack of resilience due to high levels of inequality was there all along. We could have been better prepared, had we only looked outside our borders.

Minneapolis Compared to the U.S. Leader

Below is a comparison of Minneapolis to the leader San Francisco according to the 2019 US Cities Sustainable Development Report, which measures the performance of U.S. cities against the United Nations' Sustainable Development Goals (SDGs). Seen through this lens, Minneapolis ranks in the upper midfield of American cities, not a bad place to be.

Please note: A score of 100 describes the best performance a **U.S. city** has achieved in the category.



METHODOLOGY SPOTLIGHT: What can be learned from how the Sustainable Development Goals are structured and measured?

- It's one of the most useful set of indicators to measure progress across different levels of geography
- Some criticism has been leveled against the SDGs by experts, mainly that there are too many goals with no apparent prioritization.
- Goals and indicators are treated in siloes with multiple social, environmental and economic goals listed in non-intuitive order
- This makes it difficult to understand systemic challenges and stressors, as well as points of leverage for improvement

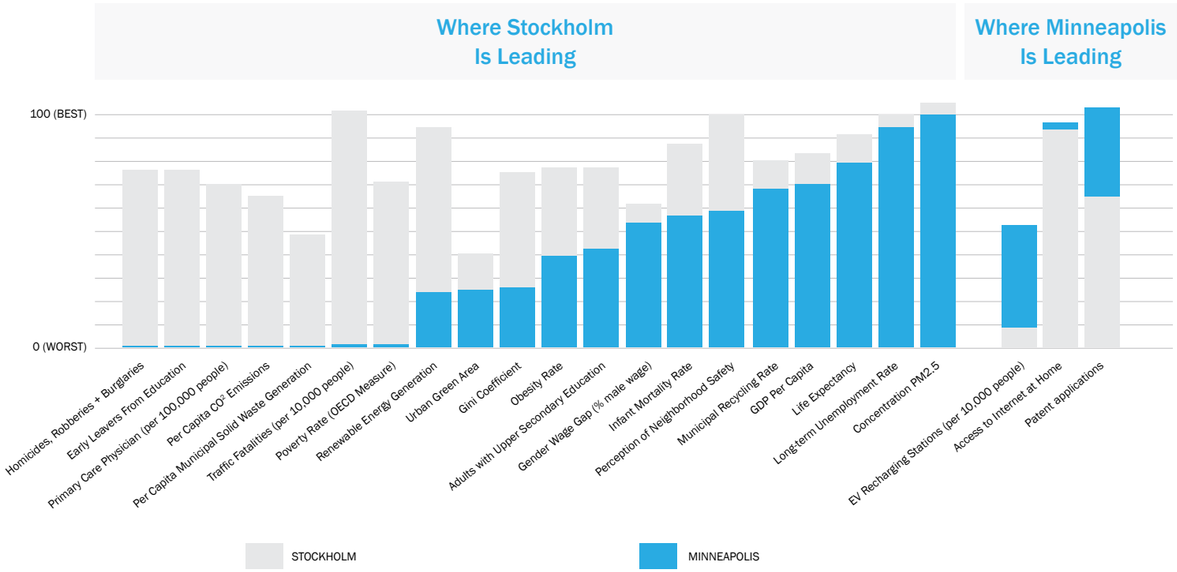
Minneapolis Compared to the European Leader

What if Minneapolis was measured against a benchmark of European Cities? Below is a view on how Minneapolis indexes against the best as defined by European Cities.

The Sustainable Development Report publishes annual updates for both U.S. and European Cities, each using their own 0-100 scale. However, due to differences scale, and in the nature of indicators dictated by publicly available data, the U.S. and European Cities studies cannot be compared directly with each other.

For this benchmark, we have used only the European indicators which are the same or equivalent to official data available for Minneapolis. For these select indicators, we are able to place the available data of Minneapolis in the context of the best and worst performers of European cities, using Stockholm, one of the European top performers, as a point of comparison.

Please note: A score of 100 describes the best performance a **European city** has achieved in the category.



Key Takeaways

- Minneapolis, a typical U.S. city, is eclipsed by European Cities on most quality of life measures, including crime, education, and access to healthcare.
- Socio-economic indicators score comparatively low, even as employment levels are similar to Europe's best.
- Minneapolis leads in technology and innovation categories reflecting unique American strengths. However, it is unclear if and how these strengths translate into growth of quality of life for all.

Return on Social Investment: A Global Perspective

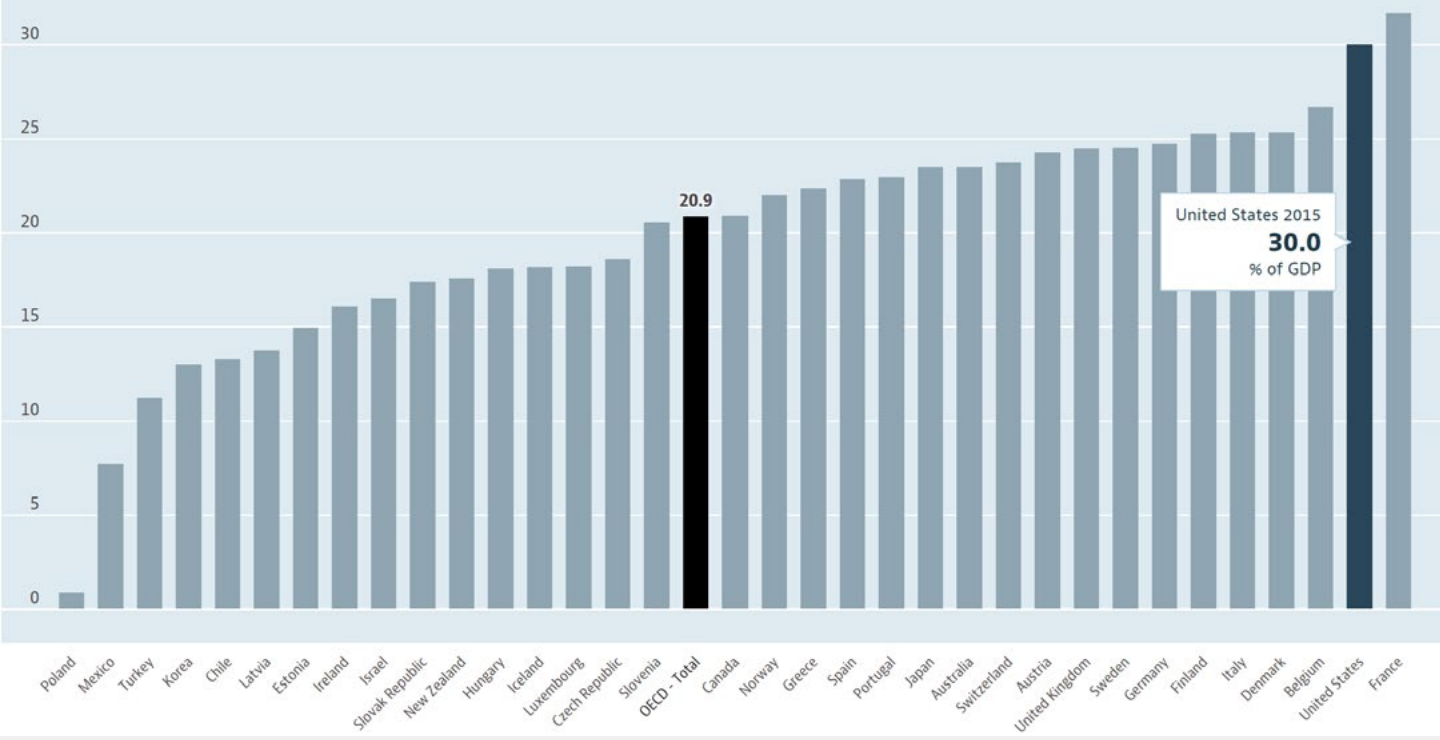
Without a doubt, American cities have less resources available than their European counterparts. In 2019, Stockholm had a budget of $5.4 billion[4], or $5,500 per resident; whereas Minneapolis had a budget of $1.7 billion[5], or $3,900 per resident.

However, when looking at total social expenditures, which includes public and private spend including healthcare and retirement, the United States is second in the world by OECD measures, with 30% of GDP allocated to public and private social spending. Sweden ranks 8th, spending 25.5% of GDP.

The high level of social spending in the United States is not matched by equally high levels of positive social outcomes. With the efficiency of public and private investments at stake, federal and local agencies, businesses and non-profits all have a vested interested in finding new models for delivering both economic growth and social wellbeing.

OECD Data on Social Spending[6]

Total net, % of GDP, 2015 or latest available



OECD Definitions: Total net social spending takes into account public and private social expenditure, and also include the effect of direct taxes (income tax and social security contributions), indirect taxation of consumption on cash benefits as well as tax breaks for social purposes.

1.2 Introduction to restorative development

What is restorative development?

A New Definition of Success: Beyond Net-Zero towards Net-Positive

Global cities face a formidable challenge: 60 percent of urban infrastructure that will be in place by 2050 does not yet exist.

At the same time, existing infrastructure is showing its age—built on a last-century model, our current infrastructure systems are not fit to withstand the challenges of the next decades, such as climate change, rising social and economic disparities, and the finite resource horizon of a linear economy.

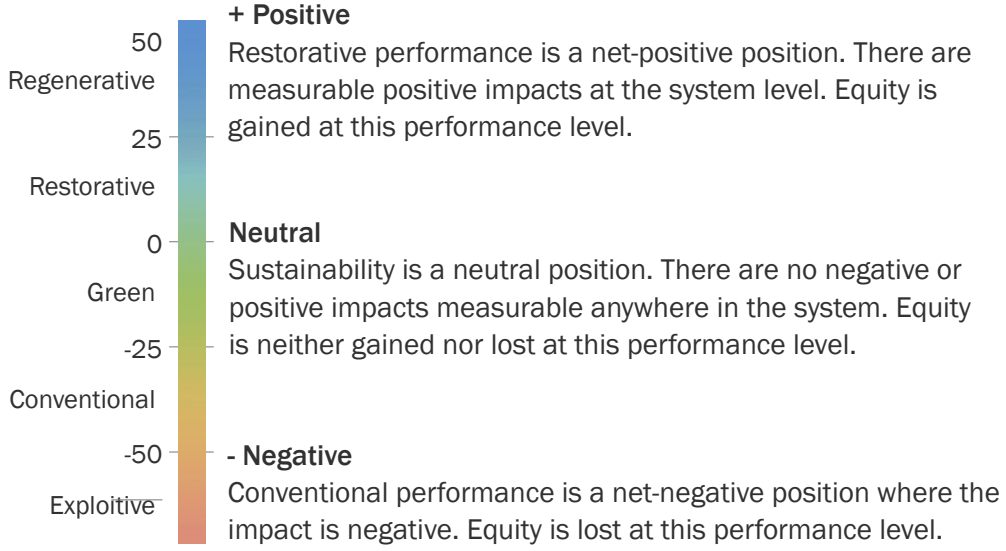
Meanwhile, businesses are heavily investing in solving complex sustainability challenges to not only achieve regulatory and social compliance, but meet rising customer expectations. However, privately funded innovations risk being siloed, and are less likely to scale across companies and entire industries to achieve maximum sustainability impact.

We believe that sustainability at scale is only possible through a new public infrastructure and governance model. The transition to a circular economy requires an effective partnership between public and private entities to develop an integrated and restorative infrastructure that can serve as a catalyst for new business models and industrial symbiosis.

Restorative development requires a new definition of success. Instead of investing in solutions that are less bad and maintain a broken system, restorative development uses true cost accounting to measure system-level equity gain and loss as an indicator of performance.

In restorative development, equity means 1) equitable access and use of resources by all people, and 2) that people in the city, and the city as a whole, have an equitable economic, social, and environmental stake in their communities.

As shown below, the midpoint on the restorative development scale is the zero point. Above this point, actions yield net positive equity, and below, they yield liabilities. No city currently scores in the positive space but some are implementing measures that are moving them in the right direction.



CORE BELIEFS:
What Restorative Developments Holds to Be True

Wealth is not measured in terms of return on isolated investments. Instead, restorative development measures and reports on holistic performance in true-cost and full-systems accounting, including community impact.

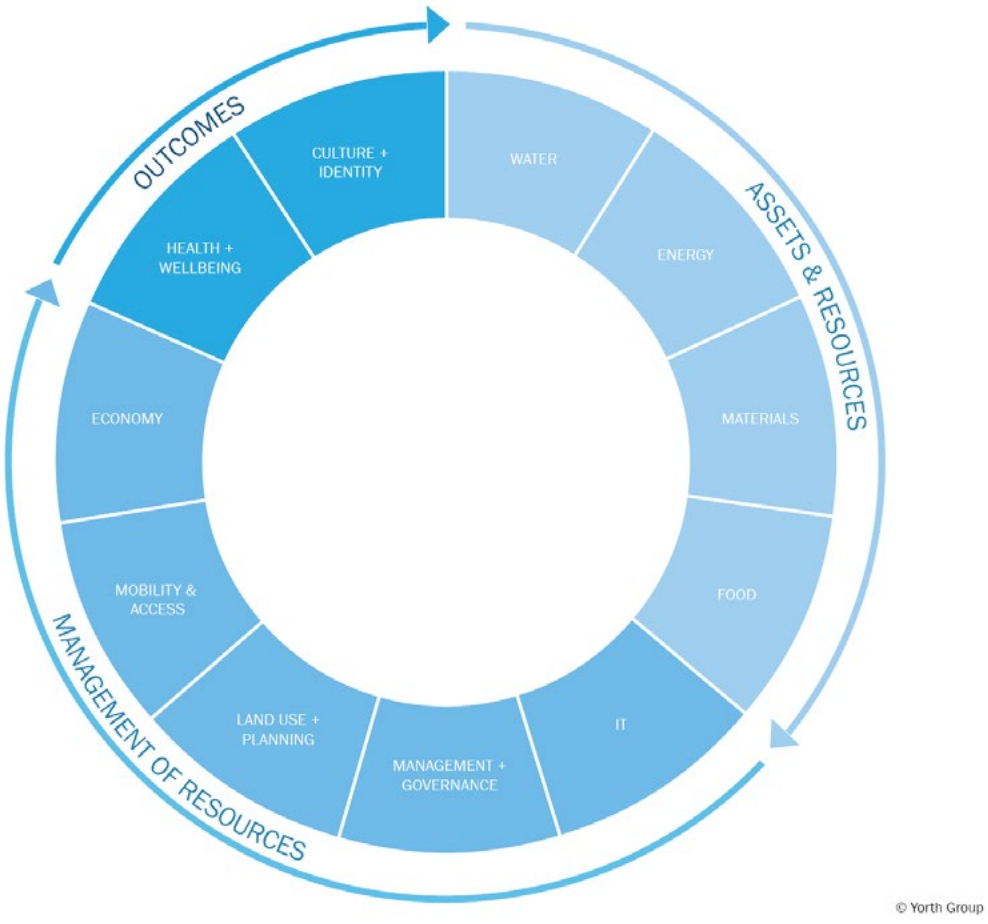
Restorative and circular development accounts for all externalities. Returns and benefits that are generated in silos and produce negative outcomes in other parts of the system are exposed and corrected.

Waste is materials. When we have the concept of waste, we build infrastructures that get rid of it. The definition of success is getting rid of waste as quickly and cheaply as possible. Conversely, when we have the concept of materials, we build infrastructures that keep materials at the optimum quality for local value creation. The definition of success becomes how much environmental, social, and economic wellbeing is being generated through repeating cycles of materials management.

A low-income neighborhood is not a liability. Instead, true-cost accounting that takes into account the interconnections between economic, social, and environmental health exposes such a neighborhood as an asset that performs at a net-negative level. This is an indicator that this asset has been overlooked in terms of investment and maintenance and therefore operates “in the red” in terms of environmental, social, and economic performance. The restorative development approach seeks to bring this asset to a level that produces net-positive outcomes.

Restorative Development: Full Resource Integration to Power a New Local Economy

To assess performance, Yorth uses its proprietary Restorative City Standard™. The Standard has 11 performance areas, each with goals and key performance indicators (KPIs). When these are managed systematically and synergistically, net-positive results can be achieved.



As shown, the performance areas create a virtuous cycle of positive action. Effectively integrating physical resources such as energy, water, and materials in closed-loop systems creates economic, social and environmental benefits. This attracts new investments, industries and employment opportunities. If managed according to restorative standards, this new local economy improves residents' quality of life, which in turn strengthens culture and identity.

Through its integrated approach, restorative development generates the following outcomes:

- Resilient and climate-proof infrastructure
- Zero-emission energy, water, materials and food infrastructure
- Energy, food and water security
- Resilient and green local economy with new jobs and career pathways
- Incentives for local developers and industries
- Increased economic, social and environmental equity across all sectors

GUIDING PRINCIPLES:
What needs to be true for restorative development to succeed

Whole Systems Optimization
Current 'siloed' development approaches optimize parts of a system at the expense of the whole. A restorative approach optimizes cities at a systems level, reducing costs and risks while maximizing value creation and stakeholder engagement.

Circular Resource Management
Resource loops are closed to eliminate waste and pollution and capture the enduring, cyclical value of all materials. All outputs in a restorative city are inputs for another part of the urban system.

Enhanced Integration
Through higher levels of integration and stacking functions, investments can generate multiple synergistic yields (outputs of value) across environmental, social, and economic areas.

Local Value Creation
All energy within a restorative system is derived from local, renewable sources. Water is reclaimed and treated on-site and available for various uses. Habitat and eco-systems are integrated into the public realm. Materials are reclaimed and reused within the local area.

Leapfrog Incrementalism
An incremental approach to innovation is well-intended but insufficient, leading to outcomes that are "less bad" while maintaining a broken system. Effective change must be disruptive, transformative, inclusive, and enriching.

Apply Salutogenesis
Instead of pathogenic, reactive responses that treat symptoms, a salutogenic approach focuses on factors that maximize the generation of health and wellbeing. In restorative development, stakeholders align to invest in the solution, not the problem.

Endnotes

1 Bankrate. A growing percentage of Americans have no emergency savings whatsoever. 2019.
Available at: https://www.bankrate.com/banking/savings/financial-security-june-2019/

2 CDC. Chronic Diseases in America.
Available at: https://www.cdc.gov/chronicdisease/resources/infographic/chronic-diseases.htm

3 St. Louis Fed. Ready for Retirement? A Question that Nags America. 2018.
Available at: https://www.stlouisfed.org/open-vault/2018/august/ready-retirement-question-nags-america

4 City of Stockholm, 2019 Annual Report.
Available at: https://international.stockholm.se/globalassets/the-city-of-stockholms-annual-report-2016.pdf

5 City of Minneapolis, 2019 Budget.
Available at http://www2.minneapolismn.gov/www/groups/public/@finance/documents/webcontent/wcmsp-217380.pdf

6 OECD. Social Spending 2015.
Available at: https://data.oecd.org/socialexp/social-spending.htm#indicator-chart

2. Performance Assessment

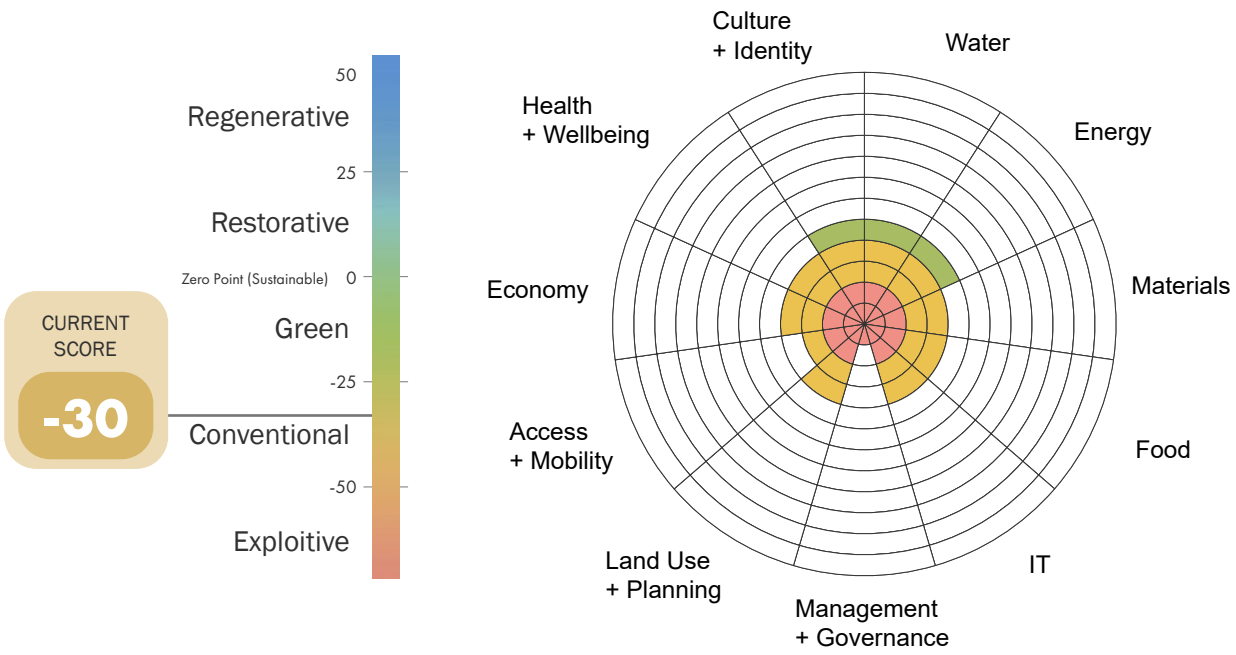
2.1 Performance Assessment

Minneapolis Restorative Performance Scorecard

2.1 RESTORATIVE PERFORMANCE SCORECARD

Assessing the starting point towards becoming a restorative city

Minneapolis Performance Scorecard



The following section reflects key findings from the baseline assessment which measures and evaluates performance across 2000 performance areas and reports in numeric scores and non-financial terms. In these numeric scores the zero point is a place of neutrality – where equity is neither lost nor generated. As in all conventional cities, the scores expose more net-negative performances than net-positives. It is important to understand that these negative scores are not stating that 'all is bad'. Rather, it exposes the fact that many good things that are being done are tainted by net-negative performances within the system that often make outcomes 'less positive' or 'net-negative'.

11 KEY PERFORMANCE INDICATORS	Total Scores	Current Status
WATER	-20.7	Green
ENERGY	-23.4	Green
MATERIALS	-35.0	Conventional
FOOD	-35.2	Conventional
IT	-27.0	Conventional
ACCESS + MOBILITY	-38.1	Conventional
LAND USE	-30.9	Conventional
MANAGEMENT + GOVERNANCE	Not rated	
ECONOMY	-31.0	Conventional
HEALTH + WELLBEING	-27.5	Conventional
CULTURE + IDENTITY	-25.6	Conventional

With a legacy of a one-of-a-kind park system and a number of F500 companies amongst many amenities, the City of Minneapolis has long been included in rankings of the most livable and healthiest cities in the United States.

However, having followed typical industrial and post-industrial development patterns, the urban system creates many negative economic, social, and environmental externalities that lead to overall negative scores, even as incremental improvements are underway. For example, having developed as a car-centric city, walkability and bikability is limited and difficult to improve.

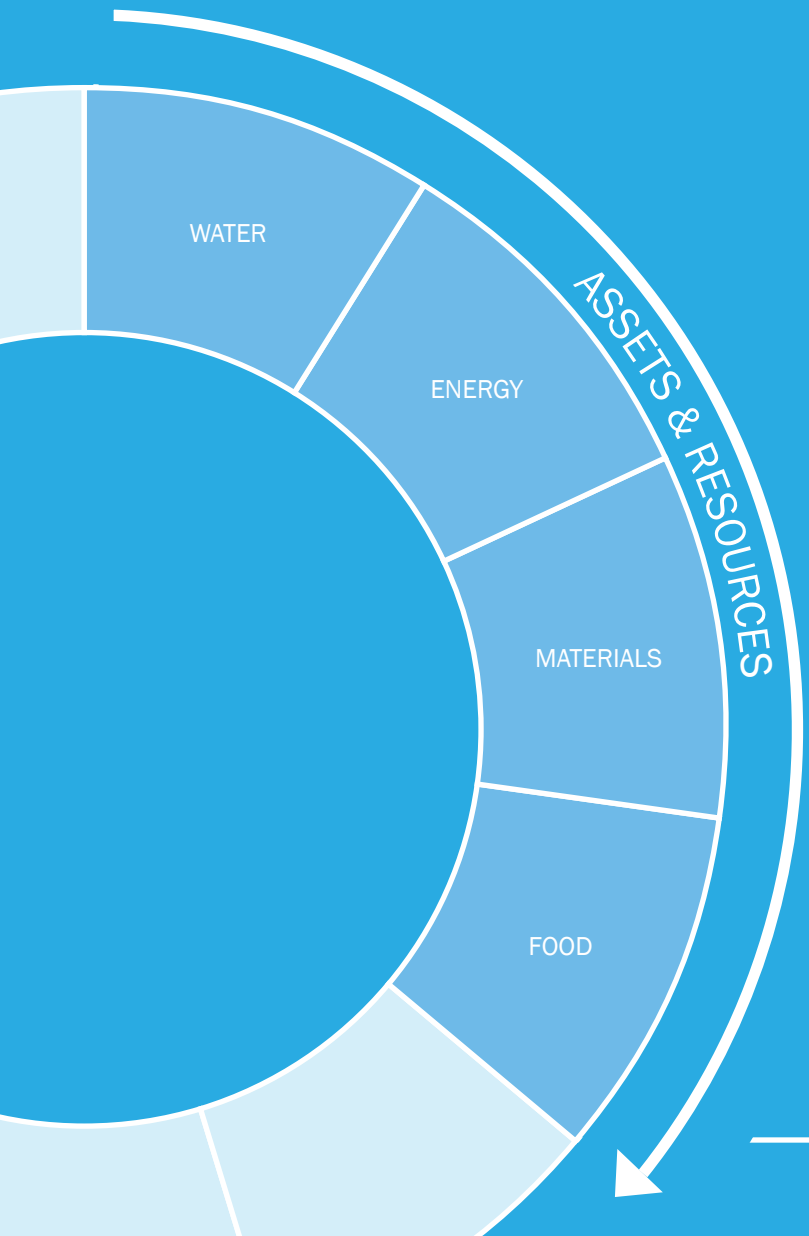
Resources, such as water, energy, and materials are managed well within their linear silos, where they are optimized for one-time use before being discarded quickly and efficiently. Closed-loop, circular principles are not yet applied to harness synergies that would yield restorative benefits. Instead, improvements are made within their own silos, and there is often a disconnect between the city's stated goals and desired outcomes on the one hand and procurement practices on the other.

Leaders at the City of Minneapolis are reckoning with the fact that the city is not livable for everyone. Confronted with its history of institutionalized racism, which has led to some of the biggest racial disparities in the nation, leaders are taking a deeper look at the impact of traditional land-use, infrastructure, and economic development practices on community wellbeing.

Please see Appendix for a summary description of each score.

2.2 From linearity to circularity

Assets & Resources



2.2 Section Overview

The assessment is based on 11 Key Performance Indicators. At optimal performance they create a virtuous cycle in restorative development.

The assessment begins with the city's assets and resources, all of which are currently managed in linear silos.

- **Water**
- **Energy**
- **Materials**
  Food

In the following chapters, we ask

- How do water, energy, materials and food systems currently work?
- Where are there losses and liabilities due to the linear nature of these systems?
- What opportunities for integration and system synergies exist?

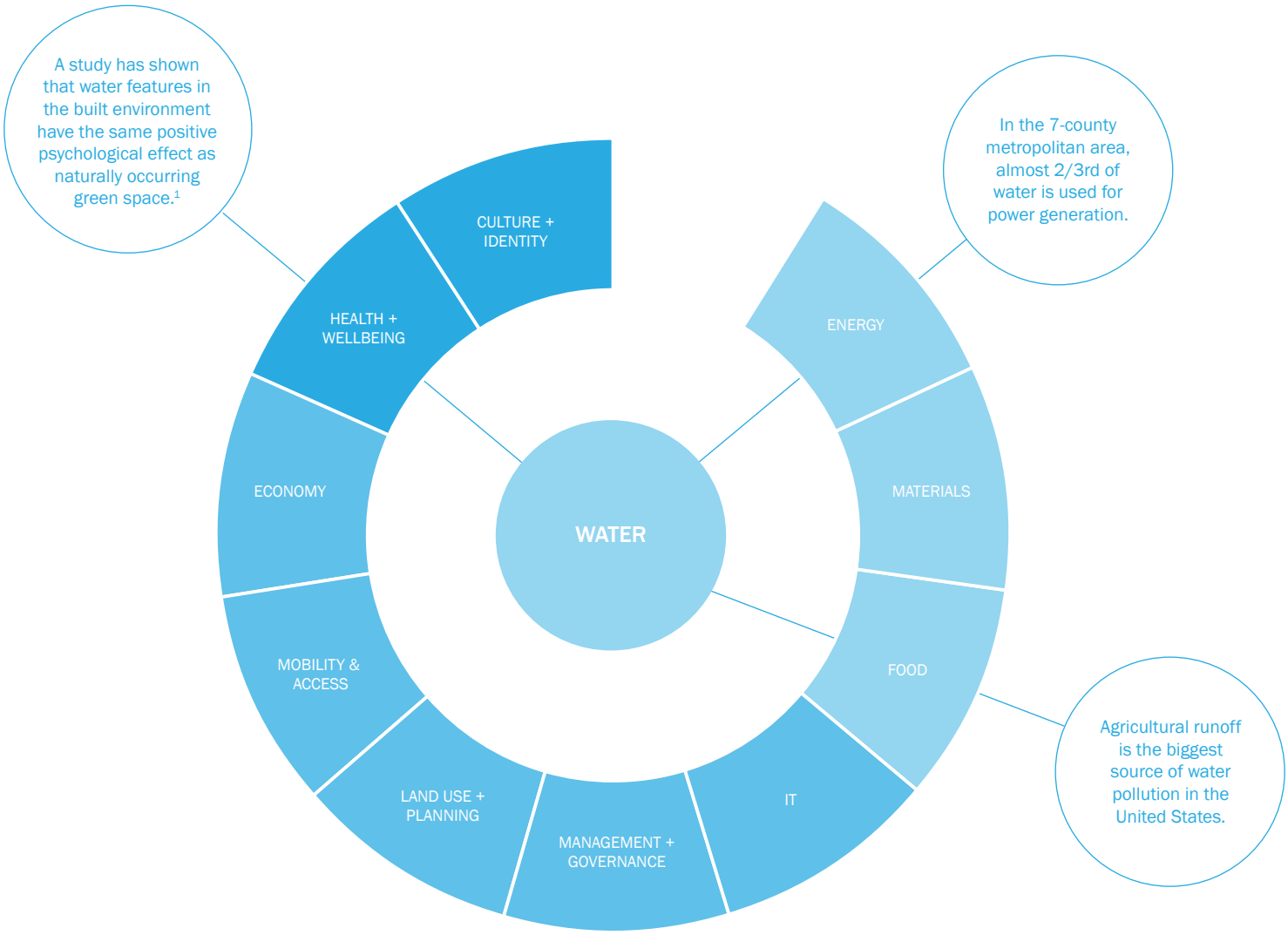
2.2.1 WATER

the axis resource

2.2.1 CHAPTER SUMMARY

FROM
Water managed in silos in linear systems

TO
Closed-loop, one-water management that is integrated with energy, food and materials systems



KEY TAKEAWAYS

- Water is managed through three separate centralized systems, where it is either treated as an asset or a liability. Each system performs well on its own, but the siloed approach does not allow for localized, closed-loop use and reuse.
- Stormwater, seen as a liability, is one of the most overlooked assets of urban resource management. The current infrastructure is not fit to withstand future precipitation amounts.
- Cities have an opportunity to take a “one water” approach, where stormwater, drinking water, and wastewater are managed holistically within one system and are fully integrated with other resource flows.

WATER
the axis resource

When it comes to water, Minneapolis is a city of superlatives. Built next to one of the world's largest rivers, the city is also not far from one of the world's largest freshwater lakes. Minneapolis—known as the "City of Lakes" because of its many urban lakes—has a deep connection with water. Whether it's an afternoon walk around a lake, a trip to the cabin, or ice-skating and skiing in the winter, residents flock to the water no matter the season.

Water has been referred to as an 'axis resource', meaning it is a resource that underlies all others. Virtually everything we interact with and utilize daily—energy, agriculture, building materials, electronics, technology, apparel—relies on water. But with increased use and subsequent contamination comes the danger of shortage, not just abroad, but in the United States, and even right here in Minnesota.

In urban areas, water has been managed through three separate systems: water supply, wastewater, and stormwater. The water supply system sees water as an asset, a resource to sell and consume. As such, governments are expected to supply it at the highest possible quality and the lowest possible cost. In the other two systems—wastewater and stormwater— water is seen as a liability, and the goal is to discard it as quickly and cheaply as possible.

While Minneapolis is a leader in drinking water purification, the surrounding metropolitan area is a leader in managing wastewater at the regional scale. However, as each system is optimized towards its singular definition of success, challenges loom as aquifers deplete at an unsustainable rate, even as surface waters swell with additional rain brought on by climate change. Governments at the city, county, and metropolitan levels acknowledge the need for a "one water" approach. While the magnitude of changing existing underground infrastructures seems daunting, no other city is better positioned to rethink and lead a different approach to managing water. Change can begin at the district scale with a closed-loop, restorative approach to water management, and then build outwards to the entire city and region over the next decades to come.

1. Water in Minneapolis and the Metropolitan Area

1.1 System Characteristics & Existing Infrastructure

Thanks to strong leadership and good governance, water has been managed well in Minneapolis and the surrounding region. For example, Minneapolis has been a national pioneer in separating its sewer and stormwater pipes, which ended the occurrence of combined sewer overflows into the Mississippi River during strong rain events.

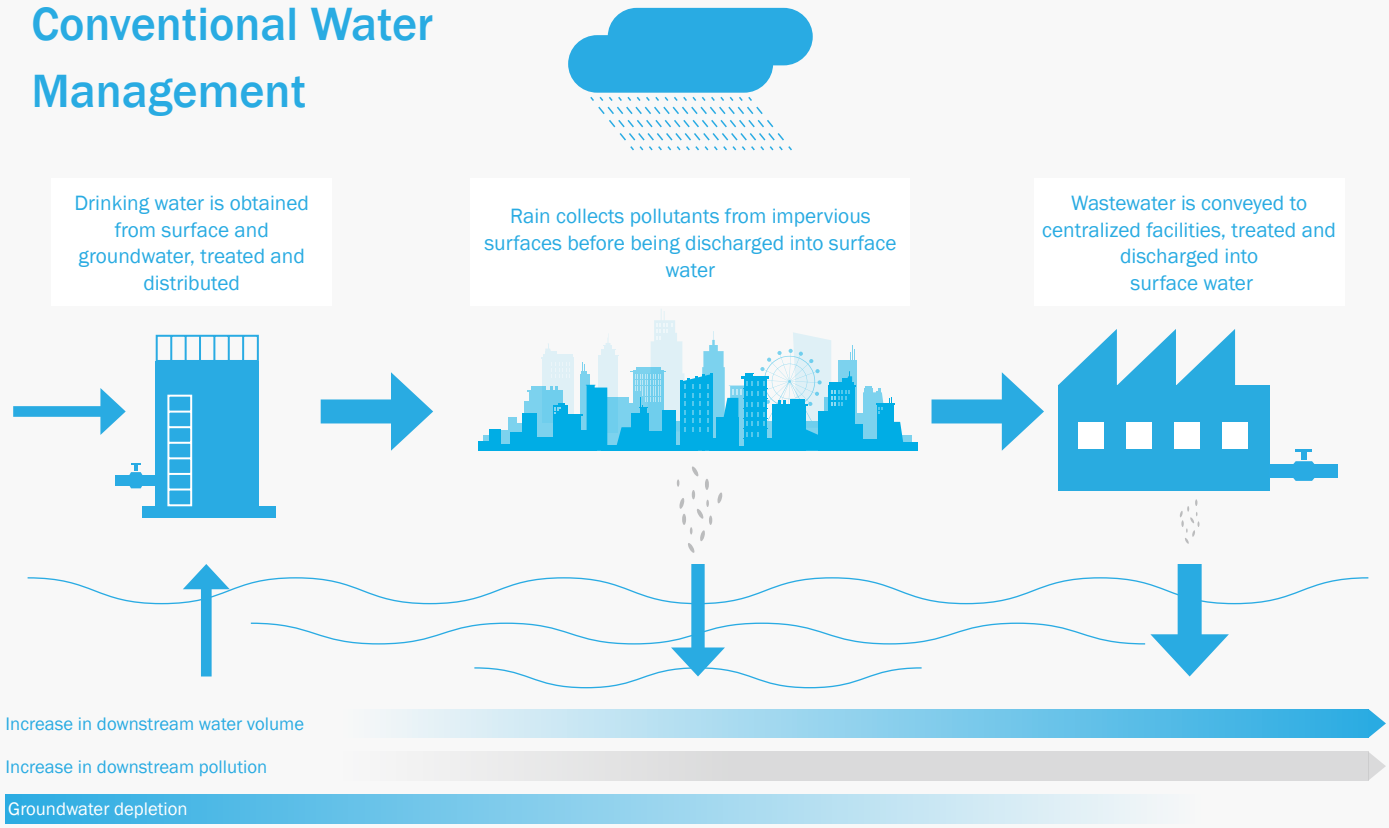
Each year, Minneapolis Public Works pumps and treats 21 billion gallons of water from the Mississippi River and delivers to its 500,000 customers at a rate of 57 million gallons a day.[2] In anticipation of stricter regulations and to hedge against the emergence of future microbes, Minneapolis upgraded one of its two treatment plants to a new membrane ultrafiltration plant, making it the largest potable water ultrafiltration plant in North America and the second-largest in the world when it was completed in 2005. The system produces some of the purest mass-produced drinking water in the United States, although it still relies on chemicals, such as chloramine, for routine disinfection.

Minneapolis' wastewater is managed by the Metropolitan Council as part of a regional management strategy. The average daily volume of wastewater generated within Minneapolis is approximately 17.2 million gallons.[3] Although most of the wastewater system is gravity fed, the Met Council system relies upon 61 pumping stations to convey wastewater to nine regional treatment plants. The Metro Plant receives sewage from 332 miles of interceptors, has a capacity of 251 million gallons, and treats an average of 175 million gallons of wastewater each day. It discharges water back into the Mississippi River, incinerates biosolids to capture some of its energy value, and collects nutrients to be used for regional agriculture. As part of its efforts to reduce stress on aquifers, the Met Council opened a zero-discharge wastewater treatment plant in East Bethel in 2014, which utilizes highly treated wastewater effluent to recharge groundwater instead of discharging it to the river.

Despite advanced technologies and innovations in treating water both before and after use, the regional water infrastructure comes with challenges that are common to any large city system.

First and foremost, managing water through three centralized systems requires separate pipe systems spanning the entire city and requiring constant updates and renewals. Finding themselves at the 'dawn of the replacement era' (a term coined by the American Water Works Association), in order to keep the system operational, authorities have little choice but to continue updating the conveyor systems that were established a century ago, even as future 21st-century demands would benefit from different approaches, such as treating stormwater on site.

Conventional Water Management



The same constraints of an outdated design encumber efforts to more effectively harness stormwater, which is perhaps the most overlooked resource of urban water management. Until recently, stormwater was seen as a liability that needed to be discharged as efficiently as possible, creating a myriad of enduring problems, even as localized urban flooding was mitigated. First, as a result of increased urbanization, more impervious surface carries larger amounts of pollution into rivers and lakes whenever it rains. A typical downtown block in Minneapolis produces about nine times more runoff than a wooded area of the same size. The city uses different methods to treat the pollutants that stormwater collects, which include among others vehicle oil and grease, construction site sediment, bacteria from animal waste, and excess lawn fertilizer and pesticides. Second, as the climate changes, rain events in Minneapolis are becoming both more frequent and more intense, leading to more frequent flooding of an infrastructure that was built for last century's rainfalls. According to Minneapolis Public Works, a 2018 study on flooding in Southwest Minneapolis estimates that $72 million in infrastructure improvements are needed to address localized flooding in that area of the city alone. This estimate represents a small portion of the investment needed to address these challenges across the entire City of Minneapolis.

1.2 Vulnerabilities

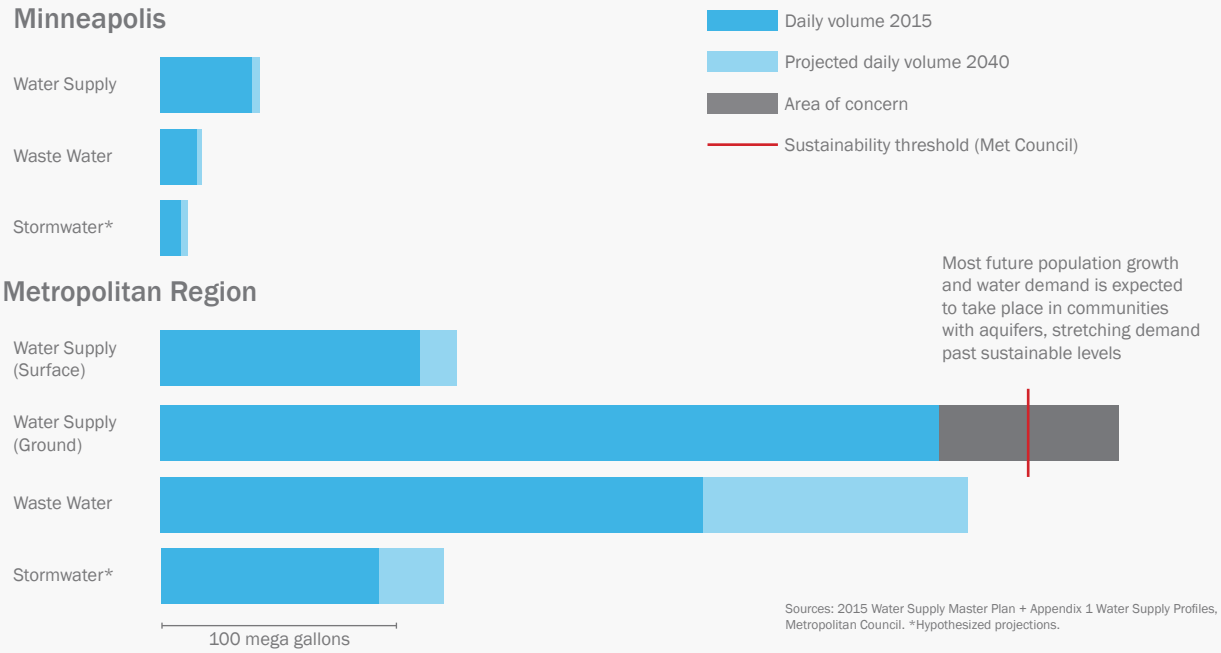
Although drinking water in the City of Minneapolis is supplied by an abundant resource, the Mississippi River, if a severe drought were to happen upstream, or if surrounding communities had to draw from it as well, the water supply in Minneapolis could be at risk.

When zooming out of the Minneapolis city limits to the entire metropolitan region, the risk to water supply takes on an added dimension, as most communities draw drinking water from aquifers that are depleting at unsustainable levels. What's more, 75% of the metro area's future population growth is expected to occur in communities where these aquifers supply municipal systems.[4] To meet future demand, the Met Council recognizes that all sources of water, including reclaimed wastewater and stormwater, must be considered as a resource.

Besides substantial aquifer decline, there is also a risk of significant water contamination. Drinking water in Minneapolis is susceptible to any contamination spills entering the Mississippi River. In addition, industrial activity has created plumes of contamination in the metro area, and nitrates and other run-off from farms are significantly impacting some metro counties. This is a story that plays out in the entire United States, where agricultural runoff is now the biggest source of water pollution.

Like any large centralized system, water supply is vulnerable to catastrophic events, such as terrorist attacks, or a prolonged power outage, which would disrupt the flow of water. There are few redundancies in the system, threatening the city's resilience to such disruptions.

Daily Volume Projections for Water Supply, Waste Water and Stormwater



Sources: 2015 Water Supply Master Plan + Appendix 1 Water Supply Profiles, Metropolitan Council. *Hypothesized projections.

1.3 Rates + Affordability

In 2019, Minneapolis residents paid an average of $30.41 a month for using around 5,000 gallons of water.[5] For 2020, such cost is expected to increase 2.8% to $31.26 and to $35.78 by 2024. For wastewater, Minneapolis residents paid an average of $31.06 a month in 2019 for using around 4,500 gallons of sanitary sewer. For 2020 such cost is expected to increase 8% to $33.54 and to $39.86 by 2024.

Minneapolis Public Works and the Metropolitan Council operate under a definition of success that is common for utilities of any type or size. Their mandate is to provide high-quality service at competitive costs, which is often defined as at or below the national average. This definition of success is accepted—and even demanded—by the public, who has grown accustomed to paying relatively little for their water, energy, and waste management.

This means that certain trade-offs are widely accepted by most stakeholders as the "cost of doing business." For example, with more than 700 new chemicals entering the market every year, there are insufficient resources—and a lack of political pressure on agencies such as the EPA—to study the effects of these so-called "emerging contaminants" that end up in our water supply. Likewise, after the point of consumption, federal rules allow for a certain amount of pollution to remain in treated wastewater that is discharged back into rivers and other water bodies. As water becomes a scarcer resource, even in water-abundant states such as Minnesota, public scrutiny is likely to increase, prompting, perhaps, a rethinking of the value of clean water, and the legal framework and investments needed to obtain it.

Water supply and wastewater infrastructures are costly to build and to maintain. For example, the Metropolitan Council's current investment in wastewater infrastructure is $7 billion. To accommodate projected population growth in the Twin Cities, the region will need to invest another $3.7 billion to maintain, replace, and expand the system in the next 25 years.

Spotlight: Stormwater and Restorative Development

Good governance at various levels of accountability has led to regional water systems that are relatively well-funded compared to the rest of the country. However, concerns exist for the adequacy of the region's stormwater system to meet future needs. Built for rainfall predictions devised as far back as the 1960s, the system is ill-equipped to handle the increased rainfall volume now and into the future. This is partially due to the challenging economics of the stormwater infrastructure, which is expensive to build and maintain, has unclear payoffs, and functions in a siloed system where water is considered a liability to be disposed of quickly and cheaply. The siloed approach to water management leads to unaccounted externalities, such as increasing amounts of run-off pollution from stormwater that ends up in lakes and in drinking water supplies, thus making treatment more costly. Further complicating the "business case" for stormwater investments is the fact that in Minneapolis, as in many places, the cost of flooding is not systematically tracked because such costs are mostly carried by private parties, such as businesses, residents and insurers.

Arguably, the key to increasing the resilience of the regional water system is to take a "one water" perspective, with a focus on rethinking stormwater. Instead of considering it as a liability it should be treated as a valuable resource with a clear financial benefit when taking into account its potential to reduce the strain on aquifers, its value as a public realm asset, and its ability to become a carrier of renewable energy in the form of hydrogen.

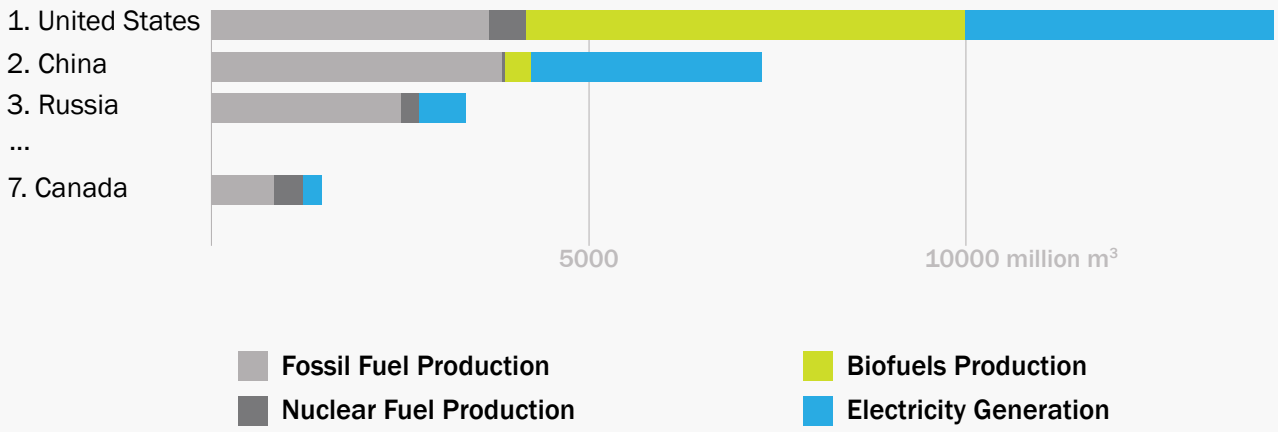
2. The Water-Energy Nexus

Minneapolis is born out of the nexus of energy and water. Built next to St. Anthony Falls, the highest waterfall on the Mississippi River, water powered the development of the initial industry that gave rise to the city.

Water and energy are inextricably linked. Electricity is needed to treat and move water, and water is needed to produce electricity. In the 7-county metropolitan area, almost two-thirds of water is used for power generation.[6] Much of this water is used for steam generation and cooling in thermoelectric power plants.

Worldwide, the United States is by far the biggest consumer of water for energy production. This is due in part to the country's high consumption of energy, only second to China, and in part to its large biofuel production to supplement oil and petroleum products in the transportation sector. The environmental benefits of biofuels are subject to much debate. Adding the amount of water used to the equation—along with fertilizer and pesticides that pollute ground and surface waters—further weakens the case of biofuels as a "green" alternative. Seen through this wider lens, the rapid rise of biofuels is a pointed example of the danger of pursuing singular goals, such as emission reductions, without taking into account systemic effects on other resource flows, such as water.

Total Water Consumption for Energy Production (WCEP) by Country[7]



Given its prominent position as a biofuels producer, this U.S. chart can be considered a strong indicator of how water is used for biofuels production and electricity generation in Minnesota, even if the water used to produce fossil fuels and nuclear fuels and its negative impacts are "externalized" to production outside the state.

In the current system, when water is used to generate energy, it is often left in a degraded state, whether through chemical pollutants introduced through fracking and industrialized agricultural practices, or thermal pollution from power plants, where warm water released back into rivers reduces oxygen and increases algae growth. What's more, the interdependence between water and energy is largely unknown to the broad public. They may be unaware that their electricity comes at a cost of water pollution, and vice versa, that turning on their faucets produces greenhouse gas emissions from the electricity used to pump it to their homes.

In restorative development, circular and closed-loop logic is applied to water. This means first and foremost, taking a "one water" approach, where stormwater, drinking water, and wastewater are managed holistically within one system. Secondly, it means water is integrated with other resource flows, including energy, food, and materials, in a way that not only produces no harm, but maximizes synergies and use.

Stormwater and wastewater can be captured, treated, and used for the creation and irrigation of blue and green habitat, for industrial applications, and for urban agriculture. The heat energy embedded in wastewater can be used for greenhouses, snowmelt of sidewalks, and other applications where heat may be needed. With an anaerobic digester on-site to treat organic waste (food and yard waste), sludge from wastewater could be used to create energy and fertilizer. Last but not least, hydrogen made from water plays an important role as a carrier of clean energy.

While all these processes happen "under the hood", public realm serves an important integrative function in restorative development. Blue and green infrastructure captures and sequesters air and water pollution, noise, and heat. District-and city-scale stormwater systems can be redesigned to integrate public pools, streams, and water ponds that support a thriving habitat, and a desired place for work and play. This can act as an important creator of regional cultural identity and become the core of a city's brand.

The key is situating all these functions close to one another, where waste from one system can serve as an input to another and be recycled multiple times over. Ultimately, this means operators need to deploy smart city technologies in a way that allows them to monitor all resource flows, including energy, water, food, and materials. It also means that cities have an opportunity to be more intentional when they zone for mixed-use and light manufacturing, prioritizing sites where such closed-loop infrastructures can be built for public and private benefit.

Endnotes

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2.2.2 ENERGY

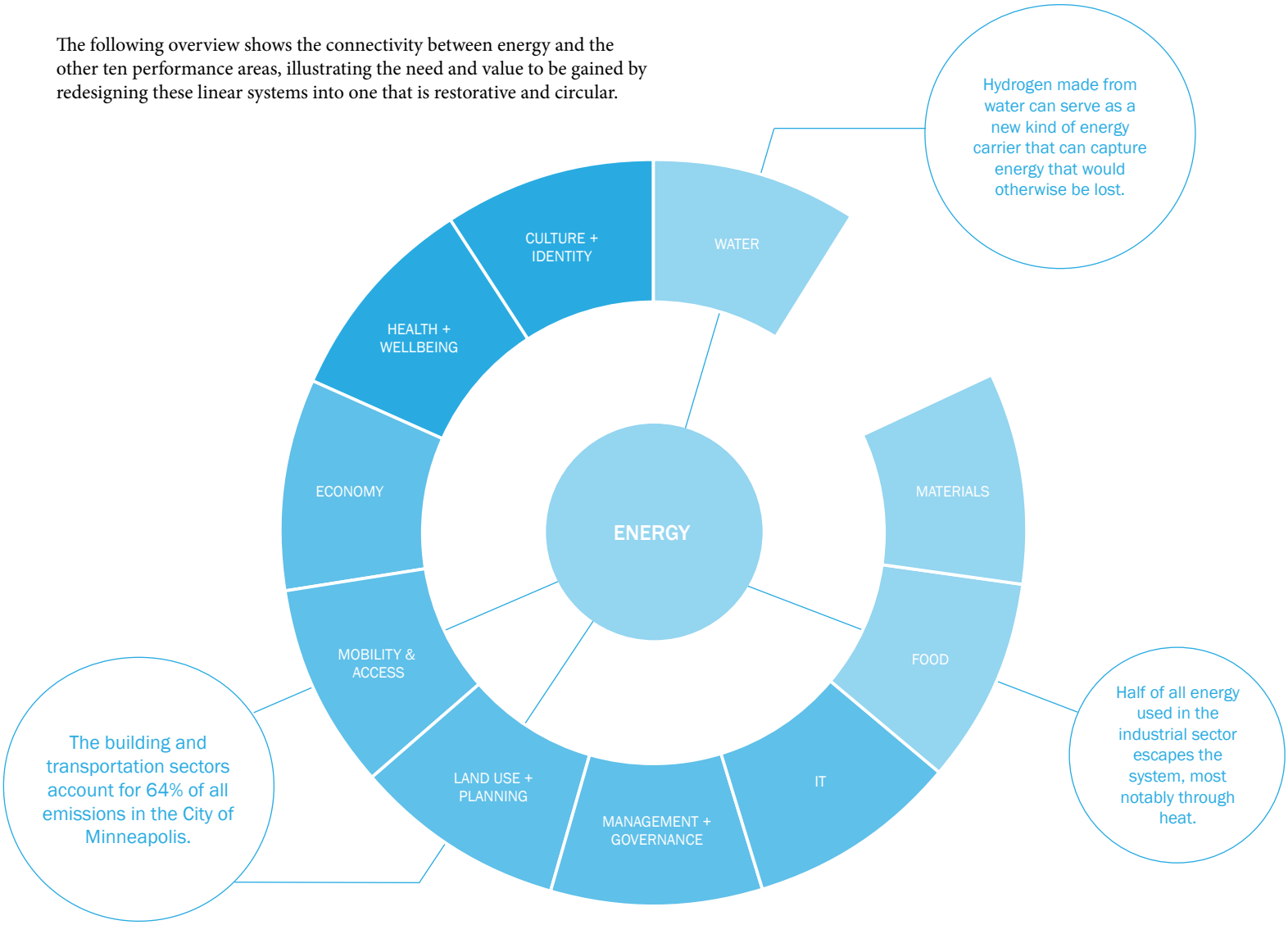
the pulse of life

2.2.2 CHAPTER SUMMARY

FROM
Centralized energy production reliant on fossil fuels

TO
Renewable energy production that is within local control and integrated with other resources

The following overview shows the connectivity between energy and the other ten performance areas, illustrating the need and value to be gained by redesigning these linear systems into one that is restorative and circular.



KEY TAKEAWAYS

- In 2018, renewables accounted for 25% of the electricity mix in Minnesota, while 38% of the overall production came from coal.
- When looking at the entire energy sector beyond electricity, renewables made up only 7% of Minnesota's energy consumption in 2017, with 75% of energy still coming from fossil fuels.
- The City of Minneapolis' 100% renewable electricity goal for 2030 differs from the goal set by the State of Minnesota and Xcel Energy, which aims to provide 100% carbon-free energy by 2050.

ENERGY

the pulse of life

Having been born into a world powered entirely by fossil and nuclear fuels, Minneapolis residents born in 1990 will see an incredible change in the energy sector over their lifetime. Not only might they be able to see the transition to 100 percent renewable energy, but they may witness incredible efficiency gains as zero-emission transportation becomes the norm, and as energy use in industrial sectors is changing in a way that may resemble another industrial revolution.

The evolution of the energy system is highly dynamic and seems to have reached a tipping point in recent years, even as a myriad of players are moving at different speeds. With the urgency of climate change looming and federal action delayed, local governments are setting ambitious renewable energy and emission reduction goals even though they may not yet have a clear pathway in place. At the same time, utilities are setting goals that may not be as aggressive but are ambitious in their own right given their business models, power plant life cycles and investment timelines.

As the energy sector is preparing for change, it presents an opportunity to look at building new infrastructure through a holistic lens, rather than silos. Many countries leading in renewable energy are learning this the hard way, as they realize that getting to cleaner electricity was the easy part but making the same progress in transportation and heating is not. What's more, there is no one-size-fits-all approach. Minneapolis is in a unique position, as it tries to balance climate leadership and racial equity goals with a relative scarcity of natural resources and harsh winters.

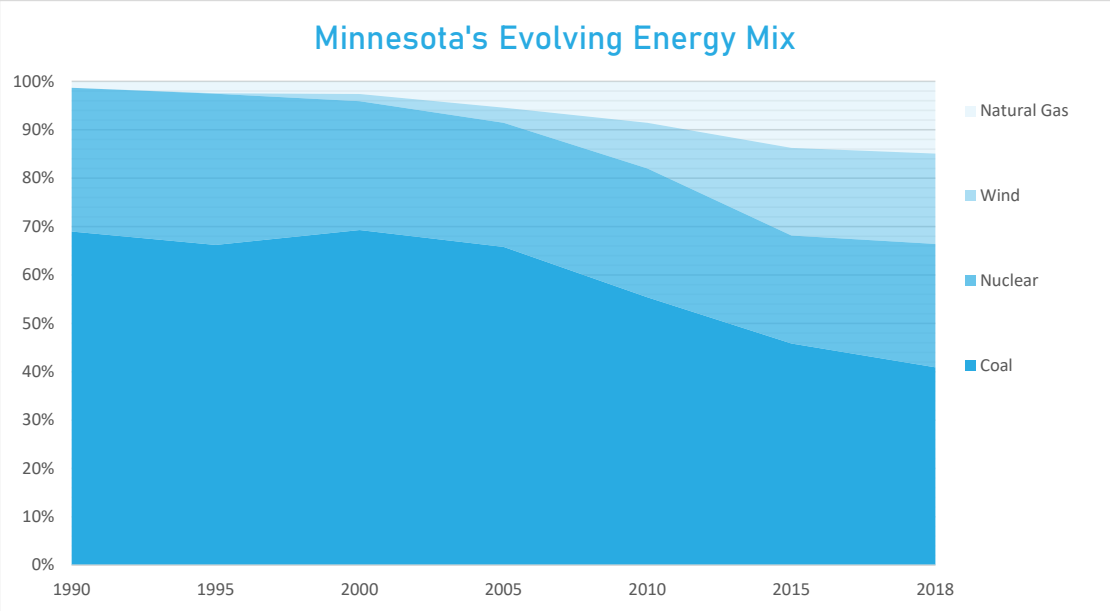
1. Energy in Minneapolis

1.1 System Characteristics & Existing Infrastructure

Minneapolis receives the vast majority of its electricity and natural gas supply from XCEL Energy and CenterPoint, the two largest investor-owned utilities in the state. Therefore, the composition of energy consumed in Minneapolis generally mirrors the characteristics of the state's energy system.

Minnesota, a net-importer of energy with 13% of its electricity coming from out of state, falls below the US average for in-state generation. However, current trends show that the share of electricity imports is decreasing.[1] With no natural resources of its own, the state imports 100% of its natural gas, coal, and petroleum from other states and Canada. This means that except for ethanol, the transportation and heating sectors are entirely dependent on domestic and international imports.

In 2018, renewables accounted for 25% of the electricity mix in Minnesota, while 38% of the overall production came from coal. For comparison, coal supplied 23.5% of electricity in the United States in 2019. Xcel seeks to phase out coal entirely by 2030, and is proposing the construction of a new natural gas plant to replace some of that capacity and ensure reliability. However, XCEL's recent purchase attempt of another natural gas plant was rejected by the Minnesota Public Utilities Commission (MPUC), because of the potential risk of the plant becoming a stranded asset when renewable energies financially outperform the estimated operational costs of gas over the next decade.[2] These two concurrent trends—falling costs of natural gas and of renewable energies—are on a collision course in regions all over the United States as utilities and regulators debate the most economic path forward.



Source: Energy Information Agency (EIA)

Electricity Costs: Minnesota vs. Germany

	Average monthly consumption (kwh)	Price (per kwh)	Average Monthly Bill
Minnesota	786	$0.13	$103.34
Germany	292	$0.33	$100.22

1.2 Rates and Affordability

In terms of energy use, Minnesota ranks 18th with regard to total per capita energy consumption, and 24th with regard to per capita energy expenditures at $3,604 per person per year[3]. Energy costs for both electricity and gas in Minnesota have long been below average, until 2016, when residential electricity rates surpassed the national average for the first time. (Commercial and industrial rates continue to be slightly lower than the U.S. average.) Since Minnesotans continue to consume less energy than the U.S. average, monthly bills continue to be below the national norm.

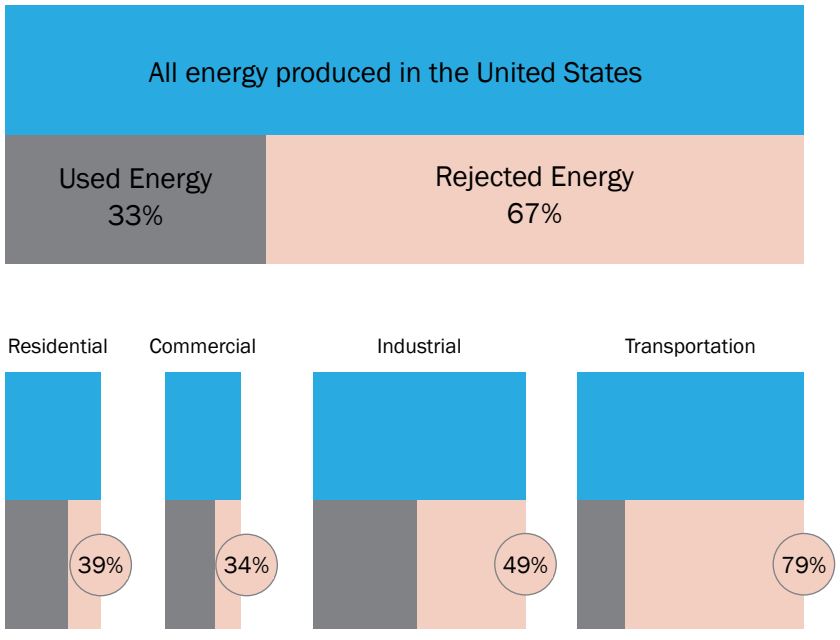
However, given that Americans have long enjoyed abundant and affordable energy sources, Minnesota's below-average consumption is relative. The total average monthly electricity bill for Minnesota households was $103.34 for 2018, the last year for which complete data is available from the U.S. Energy Information Administration (EIA)[4]. The rate in 2019 was 13.4 cents/kwh. In Germany, which is committed to phasing out coal and nuclear energy entirely, the average rate is to 33 cents/kwh[5], of which half is determined by competition between providers, and the other half by various taxes. Over the past 15 years, Germans have seen an increase of 81% in rates in order to finance renewable sources of energy, nationally and within the European Union. Surprisingly, the average monthly bill is just $100.22[6]. Although Germans and Americans have different lifestyles, this comparison seems to suggest that there is a certain price elasticity of demand and that significant reductions in electricity consumption are possible without sacrificing quality of life.

2. System Vulnerabilities: Embedded Losses and Catastrophic Failures

2.1 Embedded Losses

Even as states, municipalities, and utilities seek to decarbonize the energy sector, they continue to operate in a linear system that was born out of an abundance of comparatively cheap fossil resources. While no energy system can reduce losses completely, the current system is one where more than half of energy is lost during generation, delivery, and use, mostly in the form of heat. The Lawrence Livermore National Laboratory publishes annual flow charts that offer a visualization of the entire U.S. energy system, where 33% of energy is consumed and 67% escapes the system as "rejected energy." For Minnesota, the last such analysis was done in 2014, with the state showing a slightly "better" ratio of 43% energy used and 56% energy rejected. This is largely due to higher-than-average efficiencies in the industrial sector due to the state's relative lack of heavy manufacturing industries.

With 66% of electric energy and 75% of vehicle fuel escaping as unused heat, the state has much to gain from rethinking how to deploy new technologies and closed-loop designs in these systems. There is potential for Power-to-X applications to close loops by converting energy that would otherwise be lost as heat into liquid and gas fuels. As one of the most promising technologies, hydrogen made from water can serve as an energy carrier and the key to unlocking a new scale of energy integration between sectors, such as industry, transportation, and building heating and cooling.

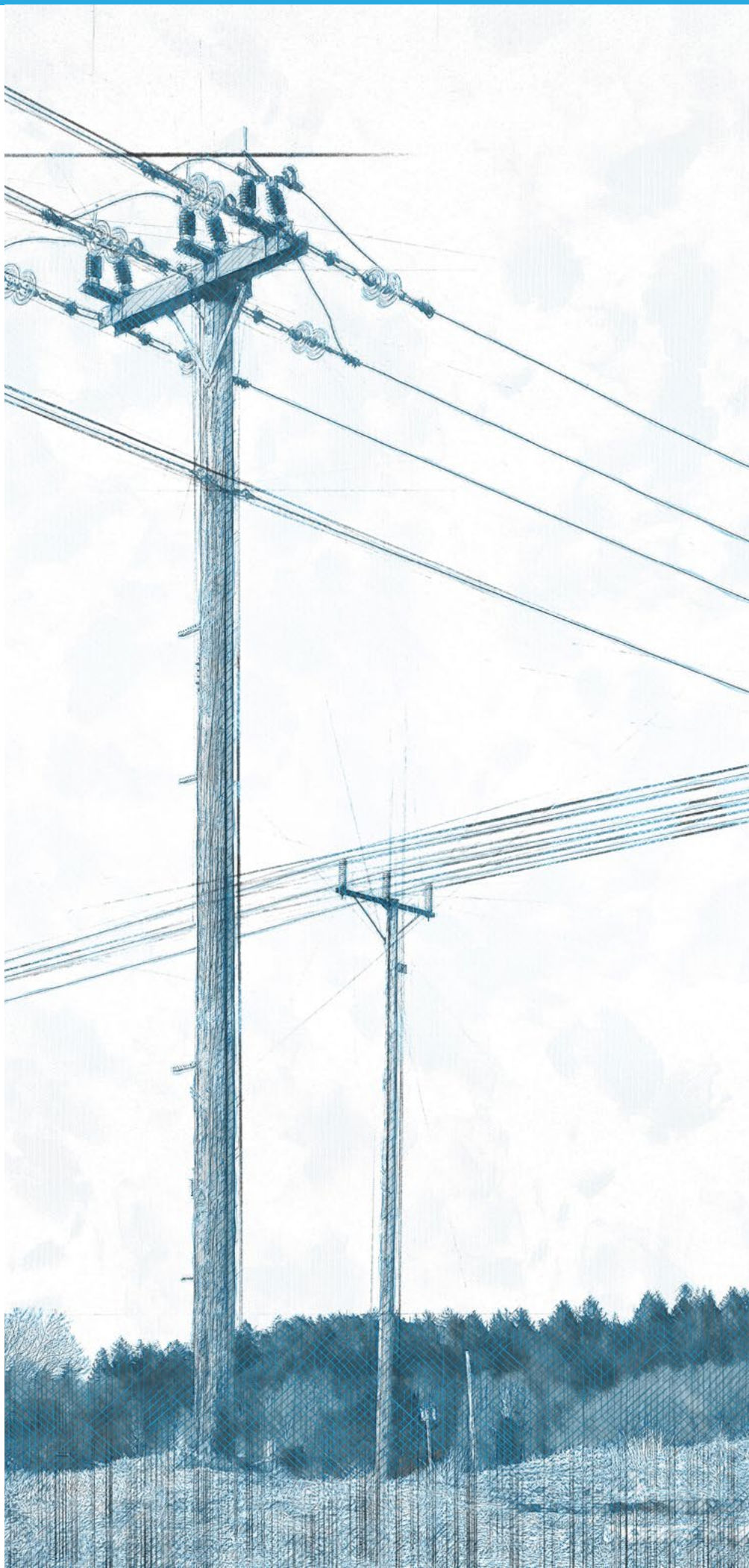


Source: The Lawrence Livermore National Laboratory

2.2 Increased Risk of Catastrophic Failure

Minnesota participates in the Midcontinent Independent System Operator (MISO), a regional transmission organization that coordinates electricity transmission across multiple states from Manitoba, Canada, to the Gulf of Mexico. Regional transmission organizations such as MISO were created to ensure efficient and reliable transmission of power across state borders. Like most American cities, Minneapolis receives its electricity from this multi-state regional distribution grid, with only 3.5% of generation taking place within city limits. (The city is targeting an increase to 10%.)

However, increasing scale to increase reliability comes at the cost of heightened risk of failure at the systems level. Because of its centralized nature, the U.S. power system is vulnerable to systemic failure in case of catastrophic events. In 2018, the National Infrastructure Advisory Council (NIAC), which included XCEL's CEO amongst other utility representatives, was asked to examine the nation's ability to respond to and recover from a catastrophic power outage of a magnitude beyond modern experience. It came to the following conclusion: "…[W]e found that existing national plans, response resources, and coordination strategies would be outmatched by a catastrophic power outage. This profound risk requires a new national focus. Significant public and private action is needed to prepare for and recover from a catastrophic outage that could leave large parts of the nation without power for weeks or months, and cause service failures in other sectors— including water and wastewater, communications, transportation, healthcare, and financial services—that are critical to public health and safety and our national and economic security."[7]



3. City of Minneapolis: Towards 100% Renewable Electricity

In 2018, Minneapolis joined hundreds of global cities by committing to obtain 100% of its electricity from renewable resources by 2030. The city established an additional goal to ensure that 10% of electricity will be locally produced and directly purchased. Worldwide, 100 cities, including U.S. cities such as Aspen, CO, Burlington, VM, and Seattle, WA, already source at least 70 percent of their electricity from renewables.[8] (Note that the information is self-reported and may include waste-to-energy and renewable energy credits depending on each city's definition of "renewable.")

The City of Minneapolis' 100% renewable electricity goal exceeds those set by the state of Minnesota and Xcel Energy. Together, the state and the utility provider have set a goal of providing 100% carbon-free energy by 2050, allowing non-renewable options in the form of carbon-free technologies that have yet to be commercialized. In the near term, Xcel is mandated to provide 30 percent renewable energy and 1.5% solar by 2020 and aims to increase the share of renewables in the Upper Midwest to close to 60% by 2030.

Xcel was the first large utility in the United States to announce a carbon-free goal, after having already made some progress in decarbonizing its grid. In Minnesota, Xcel has reduced reliance on coal from 65% in 1990 to 38% in 2018, and increased wind energy production from 1% to 18% over the same period, with much of the growth taking place in the last 10 years. In 2018, 25% of XCEL's grid was provided by renewable sources. Depending on whether the definition of renewables includes hydropower and or ethanol, this mix puts Minnesota in the top fifth of renewable energy share in the country, with additional room to grow. For example, wind has become economically viable without subsidies across much of the Midwest, which now allows comparable states like Kansas, Iowa, and North Dakota to obtain over 50% of their power from wind.[9]

In 2018, Minneapolis was powered by 26.3% renewable energy, slightly more than Minnesota's average. This is due to 3.9% of electricity coming from local and directly purchased renewable sources, namely community solar gardens and other renewable programs offered by Xcel. In 2018, over 100 new community solar gardens were added state-wide, bringing community solar to 508MW, the most of any state in the nation. By subscribing to various renewable energy programs, Minneapolis is on track to reach its operational goal, which consists of obtaining 100% renewable energy for its municipal operations by 2024.

However, the city has less control over the outcomes of its community-wide goal. With Xcel aiming to supply close to 60% renewables by 2030, the City of Minneapolis will have to find ways to bridge the gap to reach its 100% renewable electricity target in the same year.

With Xcel aiming to supply close to 60% renewables by 2030, the City of Minneapolis will have to find ways to bridge the gap to reach its 100% renewable energy target.

Environmental groups have criticized the city for allowing Renewable Energy Credits (RECs) as an option to reach this goal, highlighting the challenge the city is facing as it seeks to balance the need to demonstrate clean energy leadership, while acknowledging on-the-ground realities about the feasibility of 100% renewable electricity. From a restorative perspective, the city could benefit from taking a holistic approach that links strategies and creates optimal flows between all assets – water, energy, food and materials – rather than focusing on a single metric in a single area.

4. Heating + Cooling: The Forgotten Sector?

Minnesota is part of the United States Climate Alliance, a group of 25 states that have committed to reaching the targets set by the Paris Climate Agreement even after the federal government withdrew from it in 2016. Minnesota has a goal of reaching 100% carbon-free electricity by 2050 and shares a goal with the City of Minneapolis to reduce greenhouse gas emissions by 80%. While the electricity goal is on track, the trajectory of the transportation and building sectors (heating and cooling) is uncertain. This is significant because they account for 64% of all emissions in the City of Minneapolis[10].

When municipal, state, or national governments set goals for a transition to clean energy, public discourse typically focuses on electricity, often overlooking the contributions of other sectors, such as transportation, and buildings. While renewable energies have made great inroads in Minnesota, when looking at the entire energy sector beyond electricity, wind and other non-biomass renewables made up only 7% of Minnesota's energy consumption in 2017, with 75% of energy still coming from fossil fuels.

Other countries have begun to reckon with the true magnitude of change required. In Germany, for example, leaders also first focused the conversation on electricity, allowing the country to quickly scale renewables to 42.1% of electricity consumption in 2019[11]. However, it has become clear that the country is not on track to reach its Paris Climate Change Agreement goals outside of electricity, namely in the transportation and building sector. While experts are optimistic that the transportation sector can course-correct with greater uptake of electric vehicles, concerns persist over the building sector. Consequently, a new vocabulary has entered the public mainstream, with the notion of "Wärmewende" (heating transition) adding a new dimension to the word "Energiewende" (energy transition).

To meet emission goals by 2050, 3.3% percent of all German buildings would have to be retrofitted each year, compared to a current rate of 1%. Since retrofits are already happening and any building that will be retrofitted today will live until 2050 and beyond, this means a decision is overdue on which path to take to decarbonize building heating. The path has narrowed to two options currently under consideration by the government: 1) heat pumps powered by renewable energy, and 2) hydrogen-based synthetic fuels. While hydrogen-based power-to-gas has the advantage of reusing existing gas distribution infrastructure, in absence of decisive political action, heat pumps are likely to come out ahead in the residential sector, since they operate independently on electricity and are commercially available for any individual household.

Both the City of Minneapolis and the state of Minnesota, along with utility companies, are making significant efforts to improve building efficiency. How these efficient buildings will be powered in 2050, however, is less clear. A 2018 study commissioned by the McKnight Foundation stated that, "to decarbonize the MN economy 80% by 2050 compared with 2005 levels, the electricity sector must decarbonize by 91% and serve new heating and transportation demands as those sectors electrify"[12], but it is unclear how this electrification will happen.

In Germany, affordable air-sourced heat pumps are a viable option for most single residence households, but given Minnesota's cold winters, the same may not apply here. With current technology, to use a heat pump

RESTORATIVE SPOTLIGHT:

Since hydrogen, made from water, is a carrier of renewable energy, increased hydrogen adoption will drive up renewable electricity demand, creating interesting new ways for electricity and gas utilities to partner. In an ideal restorative development, electric and gas utilities would over time merge into a resource utility that manages multiple assets such as electricity and water in continuous closed loop cycles. Ultimately these resource utilities would manage full sector integration, as they leverage "Power to X" technologies to link power, heat and gas networks as well as the mobility sector and industrial applications in synergistic ways.[16]

without back up, homeowners would have to opt for much more costly ground-sourced heat pumps to ensure reliable heating. At a cost of upwards of $30,000 for such single-home geothermal heating[13], it is likely that Minnesota homeowners who are currently updating appliances are sticking with existing technologies, replacing a natural gas furnace with another natural gas furnace, for example, setting their homes on a fossil pathway for decades to come.

The potential barriers to electric residential heat pumps make hydrogen an even more attractive option to explore for the City of Minneapolis and Minnesota as a whole. CenterPoint Energy, the state's largest natural gas supplier, anticipates that over time, the source and chemical composition of the energy that they distribute will transition from geologic fossil fuel to a blend of natural, bio-methane (RNG) and hydrogen (power to gas). In the immediate term, the utility has filed a petition with the Minnesota Public Utilities Commission to allow Minnesota producers of renewable natural gas (RNG) to connect to CenterPoint Energy's distribution system.

In addition to hydrogen potentially meeting single residential needs, geothermal heating in Minnesota remains a promising option on a district scale, and for multi-family and commercial buildings. A 2016 study on the potential of Aquifer Thermal Energy Storage (ATES) for the former Ford site in St. Paul concluded that the Minneapolis-St. Paul area has excellent climatic and hydrogeologic conditions for ATES; and that an ATES is advantageous to a gas-fired district heating and cooling system from a financial, emissions, and resource use perspective.[14] In Minneapolis, the Towerside Innovation District is working with its partners Ever-Green Energy and Underground Energy, along with local developer, The Wall Companies, on an aquifer thermal ATES system for its 17-acre Malcolm Yards project which will house a food hall, several housing buildings and two office buildings. While the concept is common in European countries, such as the Netherlands, Sweden, and Denmark, this project is a first in the United States in terms of its scale. The project is awaiting a decision by the city council to back it financially through the sale of bonds.[15]

Whether through hydrogen or geothermal applications and heat pumps, a look into the future of heating (and cooling) brings a new resource into focus: water. These new technologies are promising, closed-loop alternatives to today's linear fossil-fuel-based systems, but only if water is abundant. Whether it's from rainfall or from previous use, it should be treated as a resource in the local economy, rather being discarded into the river and sent downstream.

Endnotes

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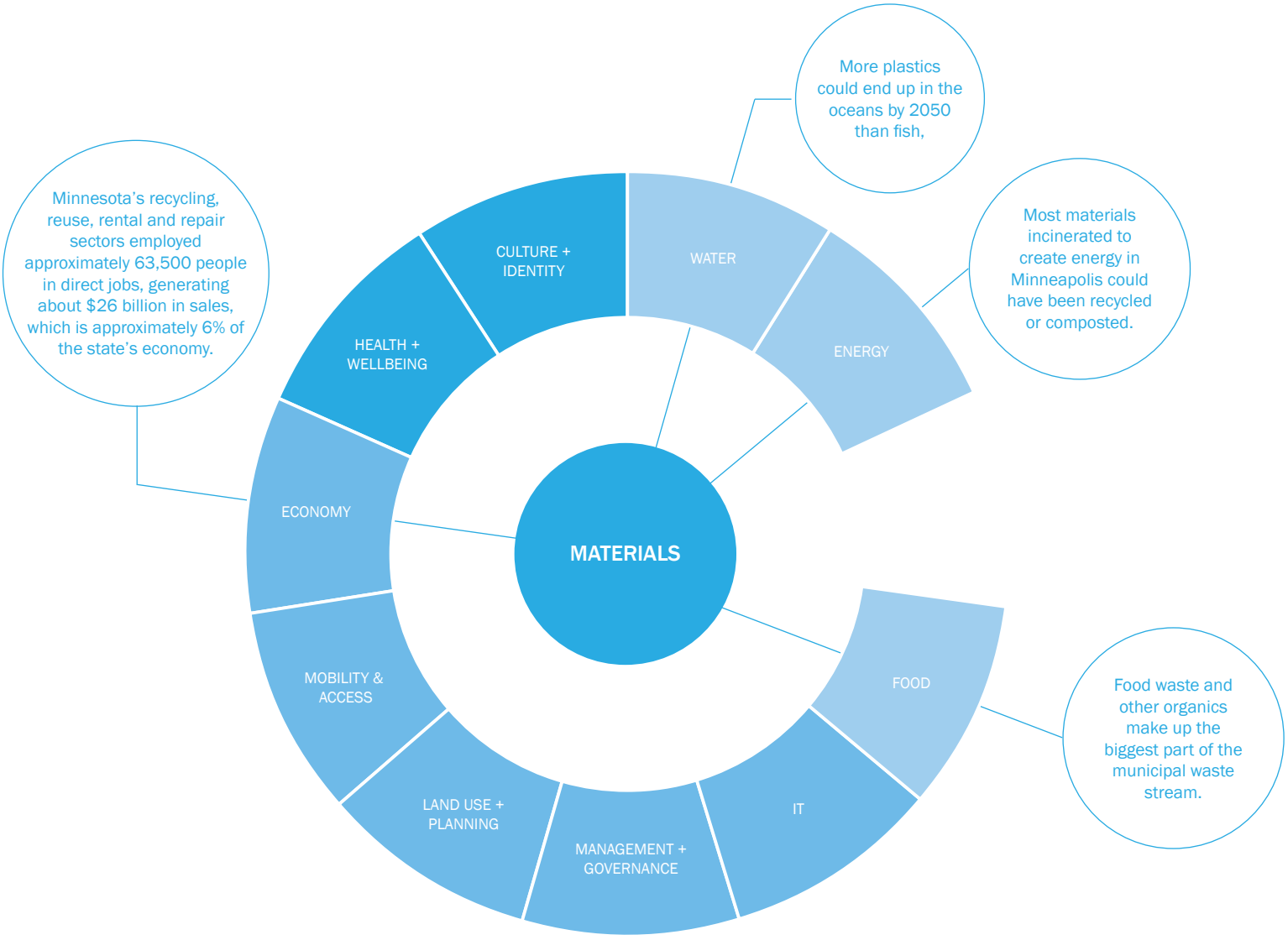
2.2.3 MATERIALS

a world of plenty

2.2.3 SUMMARY

FROM
A finite and linear take-make-waste economic model

TO
Circular materials management that keeps molecules at the highest possible value



KEY TAKEAWAYS

- China's refusal to take U.S. recyclables showed that most domestic recycling infrastructures were unable to extract value out of the mixed recycling stream, forcing some municipalities to burn it instead.
- In 2019, the City of Minneapolis recycled and composted 38% of its waste, and it aims to bring that number up to 50% of its overall waste stream by 2020, and to 80% by 2030.
- The Minnesota Pollution Control Agency estimates that by not recovering materials that could be have been recycled, $2.3 billion of potential material was discarded between 1996 and 2013 in Minnesota.[1]

MATERIALS

a world of plenty

For decades, the world has followed the linear path of the take-make-waste economy, pegging economic growth to the frequency with which consumers buy, discard, and replace products. Bound by the current growth paradigm, cities and governments have a mandate to find ways to make any waste disappear as quickly and cheaply as possible.

In the United States, as in many Western countries, authorities have succeeded at this task, enabling consumers to expand their consumption without ever seeing where the contents of their overflowing bins go, and without feeling a significant hit on their wallets from waste disposal costs. What's more, with lifestyle changes such as increased online shopping and more frequent purchases of packaged foods, many consumers now see a large portion of their waste go into the single sort recycling bin, suggesting net progress even as consumption increases to unsustainable levels.

Then in 2018 came a big change. When China refused to accept contaminated recyclables from other countries, it exposed the inadequacy of the American recycling system. It forced change unto an industry that was optimized to dispose of materials as quickly and cheaply as possible, even if that meant shipping it halfway around the globe for sorting and processing. As recyclables piled up at home, it became painfully clear that most domestic recycling infrastructures were unable to extract value out of the mixed recycling stream, forcing some municipalities to burn the materials instead.

China's ban exposed not just a crisis of recycling, but also a crisis of recyclables. For decades, the public's perception of the recyclability of plastics has contributed to its proliferation, stymieing any impulses for material innovation. With increased public awareness of the true impact—the United Nations warned that more plastics could end up in the oceans by 2050 than fish – comes an opportunity to rethink waste.

Eliminating the concept of waste in favor of closed-loop materials management, where the value of materials is maintained or even improved with each cycle, unlocks opportunities for innovation in materials design and development, and in lifecycle management. When materials are actually worth recycling, regional recycling and remanufacturing infrastructures can be built that offer living-wage jobs and workforce development opportunities.

1. Waste Management in Minneapolis

1.1 System Characteristics & Existing Infrastructure

Solid waste and recycling services within the city are provided through a combination of services from the city and private service providers.

The City of Minneapolis manages waste for single residential units, as well as for city operations. In 2019, a total of 138,816 tons (down from 141,450 tons in 2018) of material were collected by the city's Solid Waste & Recycling division of Public Works. 58% of the material was sent to a waste-to-energy facility in downtown Minneapolis, 20% of materials were recycled, and 18% were composted, bringing total diversion for 2019 to 38%. Lastly, just under 4% of materials were landfilled.[2]

The Solid Waste and Recycling Fund coordinates services related to collection, disposal, and recycling of household waste, yard waste, and problem materials, as well as organics. In addition to providing weekly and bi-weekly pick-ups for trash, yard-waste, organics, and recycling material for half of the city (single residential units and municipal operations), SWR also operates a solid waste transfer station providing service to over 107,000 households.

Funding for solid waste and recycling activities is primarily generated from solid waste collection fees through monthly utility bills, and grants from Hennepin County.

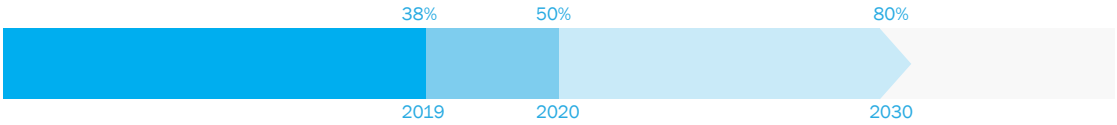
Multi-family and commercial waste management is managed by 70 private haulers. Unfortunately, there is a significant lack of data with regard to the make-up and processing of this significant portion of the waste stream. The city is currently working with these private contractors to get data on multi-family and commercial properties.

Municipal solid waste is largely incinerated in the Hennepin Energy Recovery Center. Recyclables are sent to the Eureka Recycling Materials Recovery Facility (MRF), where the

single-sort recyclables stream is processed, marketed as recovered materials that provide revenues to the city. The city has recognized the need to increase the organics processing capacity which may include an anaerobic digestion facility managed by Hennepin County.

The City of Minneapolis has joined other American and global cities in setting a Zero Waste goal. In 2019, the city recycled and composted 38% of its waste, and it aims to bring that number up to 50% of its overall waste stream by 2020, and to 80% by 2030. It also seeks to achieve a zero-percent growth rate in the total waste stream from 2010 levels. Strategies and near-term tactics to making progress include increasing the price differential between small and large trash carts to incentivize reduction of waste, and increasing recycling and organics pick up frequency while reducing remaining garbage collection to every other week.

Organics and Recycling Diversion Goals, Minneapolis Zero Waste Plan



1.2 Rates + Tipping Fees

The 2020 base fee per residence is $25.08, with an average monthly cost of $30.08. This is projected to rise to $33.44 in 2024[3]. For comparison, a household occupying a single building in San Francisco, the country's zero waste leader, pays $43.94 for garbage, recycling and organics collection. Notably, the standard size cart for garbage in San Francisco is only 16 gallons, whereas in Minneapolis, the smallest cart available is 32 gallons, with the vast majority of residents (92%) using 96-gallon carts. As it moves further along on its zero-waste journey, Minneapolis plans to create bigger financial incentives to increase adoption of the smaller carts.

The City of Minneapolis pays $58 per ton to dispose of waste to be burnt at HERC. For comparison, the average landfill tipping fee in Minnesota was $61.67[4] in 2018, and St. Paul pays $82 to dispose of waste in its waste-to-energy facility.

The City of San Francisco pays $180 a ton to its zero-waste partner, Recology[5]. In Germany, where 60% of waste is diverted to recycling, prices per ton for alternatives, such as incineration, typically range around $180, but have reached $260 for some facilities.

While lower tipping fees such as those in Minnesota can help a municipality fulfill its mandate of providing affordable services for its residents, it also stymies innovation and can hinder the development of a more robust materials management industry that could serve as a multiplier of economic, social, and environmental value.

1.3 Management of Organic Materials

In 2019, the City of Minneapolis diverted almost 25,000 tons of compostable waste to a commercial composting facility, of which almost 20,000 tons were yard waste, and 5,300 tons were source separated organics (SSO), including food waste.

Keeping organic materials out of landfills and incinerators is an important step to reducing harmful emissions, but it comes at a significant cost to the city. According to the City of Minneapolis' 2020 budget, the Solid Waste Fund spends $4.6M on "organics" (which would translate to $766/ton) and $3.4M on "yard waste" (which would translate to $170/ton). Benefits include the avoidance of tipping fees that would have been otherwise incurred by landfills, reduction in greenhouse gas emissions, and the ability to enhance soil in the city through compost.

However, composting alone may not be the most cost-efficient way to achieve these benefits. Municipal compost tends to be less nutrient-rich than comparable products and to have a higher level of contamination from plastics and other household waste (at around 0.7% in Minneapolis). The cost of composting and contaminant mitigation is mainly offset by waste collection fees since the market price for compost recovers only a small fraction of the expense.

This is why cities are actively exploring other options, including biochar, as a way to manage some of their organic materials. While the business case for biochar has yet to be made given its relative novelty and lack of data, its superior benefits in terms of energy creation, nutrient density, and ability to sequester carbon has been well documented. The City of Stockholm, for example, expects its $11M investment in a biochar production plant to be recuperated within 8 years. The financial viability of the project is based on the sunk cost already incurred through the existing collection infrastructure of SSO, the traffic administration's commitment to buy biochar for the maintenance of the city's trees, and the existence of a district heating system to which heat can be sold to.

A better way to manage organics

Today, organics and yard waste are commercially composted at a combined cost of $320 per ton, and used in city parks and erosion control projects with little or no revenue.

A restorative district system takes a more synergistic approach. At a comparable or lower operational cost, SSO and yard waste are digested to create energy in an anaerobic digester (rather than use energy as required by commercial composting). The resulting digestate is turned into compost, which is enhanced by nutrients obtained from algae cultivated through blue and green public infrastructure systems, such as streams and ponds. It can be further enhanced by biochar from a biochar production facility. The result is a more nutrient-rich, carbon–capturing product from a closed-loop process, that generates benefits and synergies in many systems that are currently managed in siloes and in a linear fashion, such as energy generation, waste management, stormwater management, public realm and park maintenance, and urban farming, including fish production.

2. HERC: From Waste to Energy

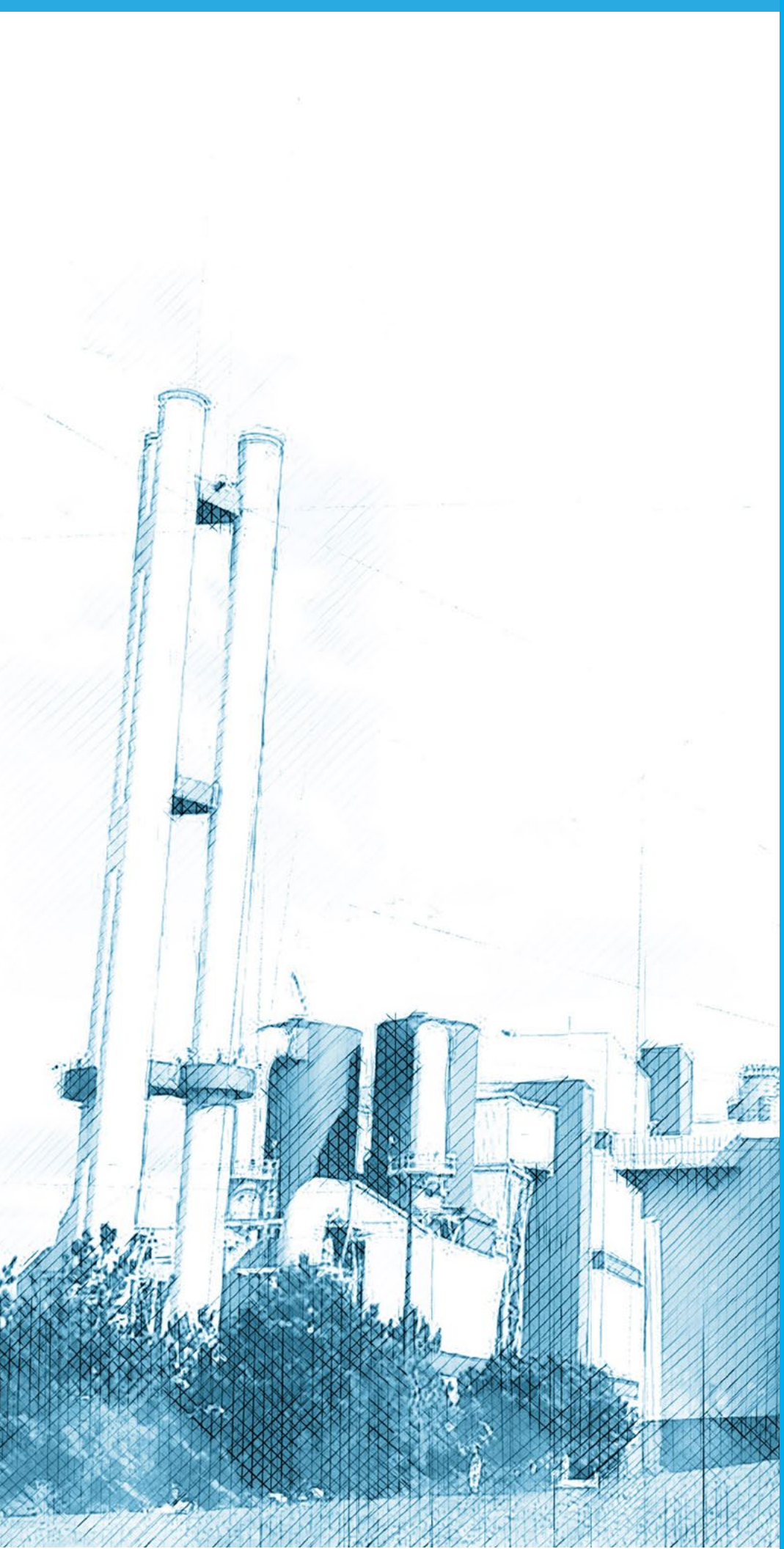
The Hennepin Energy Recovery Center (HERC) processes 365,000 tons of waste every year, generating electricity that powers 25,000 homes[6]. In addition to recovering some of the energy embedded in the materials, waste-to-energy is considered a preferable alternative to landfill which poses bigger environmental risks through higher greenhouse gas emissions, especially methane, and toxic leakage. While HERC's emissions remain under permitted levels set by the Minnesota Pollution Control Agency and federal standards, it is a source of many toxins in Minneapolis, including mercury, NOx, SOx, dioxins, furans, and particulate matter. Although no studies have been conducted to examine a possible link between HERC and emission-related respiratory diseases, communities surrounding the plant have reported higher cases of asthma and respiratory problems than in other parts of Minneapolis[7]. (It should be noted that some of these communities are subject to additional sources of environmental pollution.)

HERC was built in the 1980s as a temporary solution to divert waste from landfills until other ways of waste management, such as recycling, would become more developed. Decades later, Minneapolis has become reliant on HERC for 75% of its municipal solid waste, of which 83.5% consisted of materials that could have been composted and recycled in 2012.

Today, HERC finds its future caught between multiple visions and goals, with some sign pointing towards its ultimate retirement. The state of Minnesota set a state-wide goal of 75% recycling (including organics) by 2030. According to the Minnesota Pollution Control Agency, to achieve this 75% recycling goal, approximately 50% of the material currently going to waste-to-energy or landfill would need to be diverted from these facilities.[8] While the state generally takes a supportive stance towards waste-to-energy technologies, this indicates that materials that are currently being incinerated can be more efficiently managed up the waste stream. Under this scenario, Minneapolis (and the entire metro area) will not generate enough material to operate HERC at full capacity.

Countries such as Sweden and Germany, who are leaders in waste-to-energy, face a similar dilemma when trying to reach recycling rates set by national and international goals. As they recycle more, and having already heavily invested in capital-intensive incineration facilities, they need to import waste from abroad in order to keep the investment viable. In doing so, they de facto import toxins and pollutions to burn near their cities, all in the name of a waste management strategy that can only be considered a success when compared to landfills.

The City of Minneapolis, meanwhile, has issued multiple planning documents that indicate it doesn't see HERC as its future. The city's Zero Waste Plan does not consider waste-to-energy as an acceptable way to dispose of waste, and the resolution to run Minneapolis on 100% renewable energy by 2030 does not consider waste-to-energy a renewable source. The Zero Waste plan states: "Furthermore, there is a strong community interest in reducing the quantities of materials transported to HERC for energy recovery and increasing the quantities of materials reduced, reused, recycled and recovered to create local jobs associated with these activities."[9]



The Restorative Mindshift

Thirty years ago, investing in waste-to-energy may have come with good intentions to solve the landfill crisis. However, taking the “less bad” approach to addressing one problem in isolation did very little to change the trajectory of the broader, systemic issue: the increasing generation of waste. Indeed, our growing ability to whisk waste away quickly and efficiently—out of sight, out of mind for producers and consumers alike—has almost certainly allowed cheap, low-value materials to proliferate, and may very well have kept us from developing alternatives to single use plastics and other hard-to-recycle materials a long time ago.

In a restorative system, “less bad” approaches are never acceptable, because over time they turn from a well-intentioned ‘patch’ to an integral part of a broken system. As a guiding principle, when the path has narrowed to a choice between a “bad” and a “less bad” option, we need to acknowledge that no good decisions can be made. Instead, it should be taken as a sign that we are asking the wrong question and that we need to reframe the problem, until alternative solutions are possible that are win wins for everybody.

3. Towards a Local Economy of Materials Management + Industrial Symbiosis

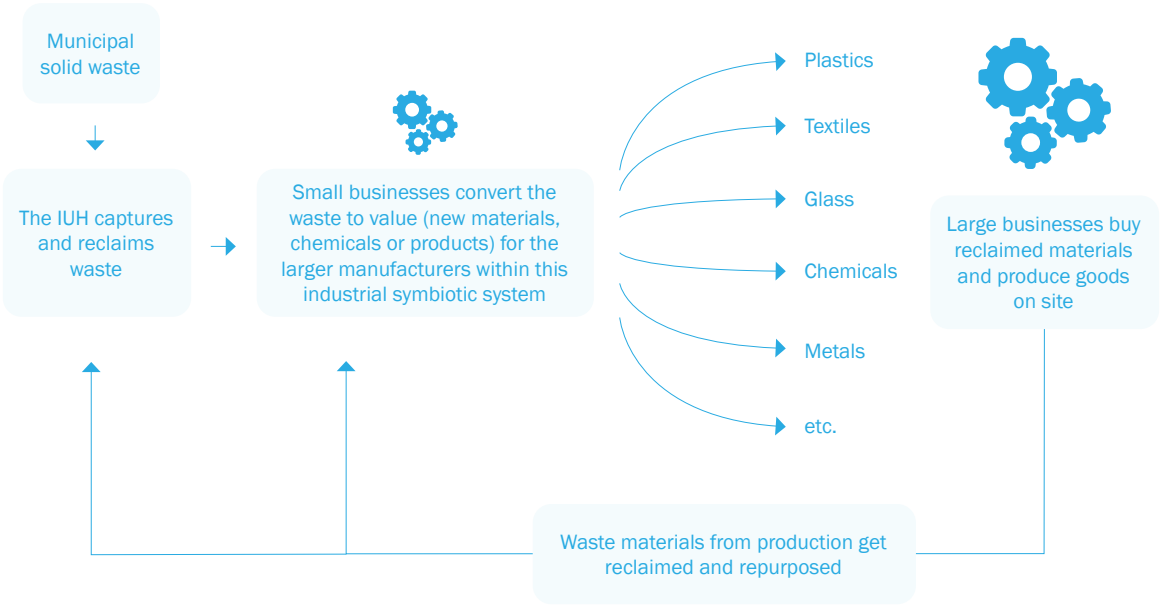
While other cities had to send their mixed recycling to incinerators following China's ban on imports, the impact on Minneapolis and St. Paul was cushioned by the increased resilience of the local recycling infrastructure, which is rooted in a long history of selling materials to regional Midwest markets. Furthermore, residents are doing better-than-average in keeping contaminants out of their recycling, thus increasing the amounts of materials that can be recovered. Lastly, the region is home to a non-profit recycler, Eureka Recycling, that has become a national model for its workforce development opportunities and living-wage jobs.

Statewide, the Minnesota Pollution Control Agency (MPCA) is a champion of expanding the state's recycling industry through a deliberate Recycling Market Development Program. A 2015 MPCA report estimated that the recycling, reuse, rental and repair sectors employed approximately 63,500 people in direct jobs, generating about $26 billion in sales, which is approximately 6% of Minnesota's economy. The report also estimated that "by not recovering materials that could be have been recycled, $2.3 billion of potential material was discarded between 1996 and 2013 in Minnesota."[10]

However, today's relative success in recycling should not stymie more ambitious efforts to rethink materials management. The reality is that most recyclables are subject to volatile market conditions, and some recyclables may never be recyclable in an economically feasible way. A 2017 study estimated that only 9% of all plastic ever produced has been recycled. Furthermore, these 9% would have largely been downcycled, meaning not only did they have no effect on demand for virgin materials, they also eventually will end up in landfills.[11]

INTEGRATED MATERIAL RECLAMATION, TREATMENT AND REMANUFACTURING PROGRAM

This process flow describes a closed-loop materials management program that could be housed in an Integrated Utility Hub (IUH)



Cities have an opportunity to invest in business incentives and in a recycling infrastructure that supports material management far into the 21st century. For example, London, one of the global fashion hubs, is investing in an infrastructure that would allow it to become a hub for circular economy textile design, returning a projected $1 billion per year in benefits. This presents an opportunity for manufacturers to spur the development of continued use of materials that are more easily remanufactured and kept at high value.

For the Minneapolis/St. Paul region, multiple 'hub' opportunities are conceivable.

For the Minneapolis/St. Paul region, multiple 'hub' opportunities are conceivable. For example, chemical recycling is emerging as a promising alternative to turn single-use plastics into virgin quality building blocks or even into higher-value materials, which could be of interest to local retailers and medical device manufacturers. Likewise, the region could become a Midwest electronics recycling hub, capitalizing on the opportunity for workforce development and creation of living wage jobs.

Future-proof material management means materials are designed, used and reprocessed in a way that maintains or increases their value. This requires innovative public and private partnerships, with both sectors coming together to build the system to support new products. Ideally, local infrastructures leverage industrial symbiosis to connect small and large businesses with local utilities to create closed-loop flows of materials, energy, water and by-products.

3.3 Construction & Demolition (C&D) Waste: A Massive Opportunity

Buildings currently generate almost 40% of global greenhouse gas emissions, with building operations contributing nearly 28%, and building materials and construction accounting for 11%[12]. In order to meet the commitments of the Paris Climate Agreement, the world would have to eliminate all GHG emissions from the built environment by 2040.

The City of Minneapolis is heavily invested in increasing the efficiency of buildings to reduce the city's carbon emissions, but with the city poised to continue its growth trajectory, how buildings are built is going to take on increasing significance. In fact, one of the biggest opportunities in circular materials management can be found in the built environment and construction industry, which stands much to gain from materials innovation and the development of new business models, as well as reclaiming and recycling of current waste.

In the current system, from the first to the last swing of the wrecking ball, the swift demolition of a building is devoid of concern for preserving any residual value of the materials. Here again, a network of private haulers has evolved to get rid of the waste as quickly and efficiently as possible. Due to the distributed, private nature of the C&D waste management business, decision makers have very little data with regard to the make-up of construction and demolition waste in Minnesota. The MPCA estimates that in 2017, the 1.6 million tons of documented C&D that were sent to landfills make up only 15.7% of the estimated total, stating that "MPCA does not have the data to conclude if the remaining 84.3% was sent to landfill, transferred out of state, reused, recycled, or managed elsewhere."[13]

Case Study: London Waste and Recycling Board's Circular Economy Route Map

The London Waste and Recycling Board (LWARB) is at the forefront of London's Circular Economy strategy. They estimate that out of all their focus areas, the built environment offers by far the biggest opportunity for net benefits. Finding ways to keep buildings, products and materials at their highest value for as long as possible could lead to GDP growth of between £3bn and £5bn annually by 2036.[15]

Consequently, LWARB's overall vision is for London to be a center for both design and demonstration projects that will exemplify:

- Buildings designed for adaptability, with the intention that they can be disassembled at end of life.
- Buildings that use innovative products and technologies to be more circular.
- Buildings being re-used and refurbished instead of demolished.
- Buildings deconstructed to enable maximum material re-use.
- The use of innovative business models which enable both current and new buildings to be used more flexibly and therefore perform more efficiently.
- Durable infrastructure that can adapt over time.

This means that not only are large amounts of C&D potentially entering unlined landfills and contaminating groundwater, but it is also a lost opportunity of retaining value through reclamation and repurposing.

In addition to reclaiming as much from existing buildings as possible, restorative development is in line with circular principles that focus on the whole lifecycle of construction products in a way that preserves resources and closes the loop. This means there are numerous business opportunities in rethinking the way we design, build, use and deconstruct buildings (See London case study). However, given the long lifespan of buildings, new public and private collaborations are required to align today's incentives and future rewards in a way that benefits private and public interests alike.

One example of innovative construction methods that are both modular and sustainable in nature are mass timber technologies, such as cross-laminated timber (CLT) and nail-laminated timber (NLT), which have allowed builders to construct high-rises with an environmental track record superior to reinforced concrete or steel.

T3, the largest modern mass timber building in the USA, was completed in Minneapolis in 2018. Designed as an office space that promotes health and wellbeing, the building uses 3,600 cubic meters of sustainably sourced wood in the structure, which will sequester about 3,200 tons of carbon for the life of the building.[14]

Notably, the mass timber panels were constructed in Winnipeg with timber sourced from the Pacific Northwest, and the building's beams (glulam members) were sourced and shipped from Europe. In the future, the mass timber materials could be fabricated closer to home. In 2019, the Bureau of Business and Economic Research at the University of Minnesota Duluth released a study that concluded that given our natural resources and existing infrastructure, Minnesota would be an ideal home for a mass timber manufacturer that could capitalize on the global expansion of the industry, which is projected to quadruple in size to $2 billion annually by 2025, with North America as the second-largest market.

Endnotes

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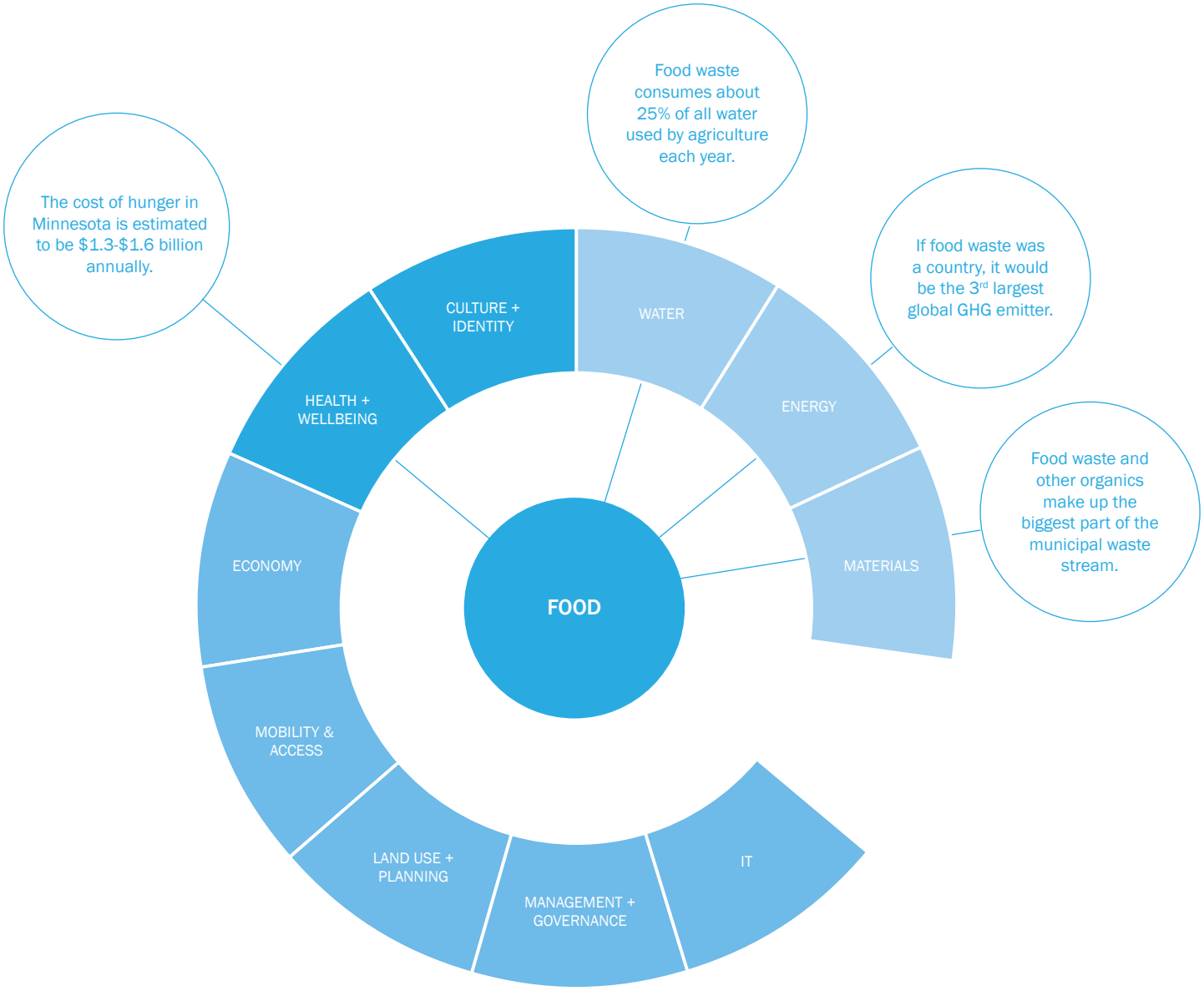
2.2.4 FOOD

closing the loop

2.2.4 SUMMARY

FROM
A global system of misallocated resources

TO
Local and sustainable food systems



KEY TAKEAWAYS

- Food is part of a heavily specialized and centralized system which achieves high efficiencies within silos, but causes significant externalities and misallocation of resources at system scale.
- While solving hunger is not as easy as simply reallocating food that would otherwise go to waste, it is useful to know that the annual retail value of food waste ($160B) almost equals the annual costs of food insecurity in the United States ($162B).
- Cities will have to play an important role in future food supply. However, the only way to do so economically is a wholly integrated approach with water, energy and materials management.

FOOD
closing the loop

Whether it's a trip to the supermarket, or a click on a delivery app, at no other time in history has it been easier to get food on the dinner table for so many people. Yet the simplicity of purchase belies the hidden complexity of the food system.

Paradoxically, food is so cheap that we can collectively afford to waste a third of it, yet it costs so much that 37 million Americans continue to struggle with food insecurity even during a decade of economic growth. With every food item traveling an average of 1500 miles[1] before being consumed, the economics of food remain somewhat of a mystery to the average consumer, whose lunch salad is more likely to be shipped from California—a state suffering from a water crisis—than from their home state.

Given the myriad of externalities that the industrialized food system produces—emissions, soil depletion, antibiotic resistance, to name just a few—putting a number on the true cost of food remains difficult. A popular symbol of a food item that is priced too low when considering the environmental, social, and economic externalities is the hamburger. To price these externalities, estimates from different sources range from an extra $1.52 per burger[2] (taking into account the embedded water, greenhouse gases, and future health care costs) to $200 for a burger, if the cattle was raised on cleared rainforest land[3].

If the food system is global, and most policies are national, the impact is most acutely felt at the regional level, whether it's school lunch policy to mitigate child hunger, the impact of chronic diseases, or a city's resilience and local infrastructure's ability to supply food in the face of catastrophic events.

Restorative development calls for a future where food is affordable for all, yet externalities are fully accounted for. With the rise of urban agriculture, cities are in a unique position to model closed-loop, waste-free food production methods that can serve as local economic engines, increase health and wellbeing, and add resilience. In order to make the case for investment, it's important to examine the cost of food insecurity, the cost of food waste, and the role that localized, closed-loop production can play in alleviating both.

1. Food in Minneapolis and Minnesota

1.1. System Characteristics & Existing Infrastructure

Minneapolis—and the entire state of Minnesota—are deeply embedded in the national and international food system. Data is scarce on how much food is grown and consumed in-state, and how much food is imported from other states or countries.

In the United States, Minnesota ranks 5th in agriculture production, with corn (26%) and soybean (19%) the largest commodity shares, followed by hogs (15%), cattle (12%), and dairy (10%). Minnesota exports 40% of its agricultural production nationally and internationally. With much of the state's production going to either animal feed or exports, the food that ends up on Minnesotans' plates is largely imported, much of it from abroad, in line with national consumption patterns. According to the Federal Food and Drug Administration, 15% of the U.S. food supply is imported, including almost 95% of seafood, more than half of fruit, and one-third of vegetables.[4]

Seen through a more localized lens, the following picture emerges for food supply in and around the City of Minneapolis. At the county level, hypothetically, a ton-to-ton comparison reveals that Hennepin County could supply 27% of the food demand in Minneapolis. Of the 54,284 acres currently farmed in Hennepin County, 86% of outputs are corn and soy, 9% are eggs, and 4% are vegetables and fruits.[5]

In 2019, there were almost 30 farmers' markets in Minneapolis, drawing 2.4 million visitors.[6] Collectively, vendors farmed 11,200 acres and food traveled an average of 38 miles from farm to market.[7] In addition, there were 295 community gardens in 2017 for cultivation at the neighborhood level.[8]

The City of Minneapolis is one of more than 170 cities that have signed on to the Milan Urban Food Pact, which includes a focus on increasing local food production in urban and peri-urban areas. As part of the creation of the forthcoming Food Action Plan, the city is currently exploring these goals, amongst others:

- Increase (double in 5 years) the overall amount of sustainably produced "local" urban agriculture in ways that help achieve multiple community-wide outcomes (environment, health, well-being, local food economy.)

- Decrease (by 50% in 5 years) the population without access to urban agriculture within the city (with attention to food justice, climate justice, economic inequalities & health disparities.)

1.2 Rates & Affordability

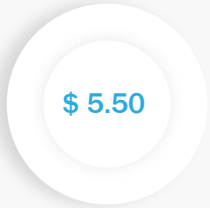
Despite being a top agricultural producer, Minnesota ranks amongst the top 10 U.S. states with the lowest retail access to food. Based on the distance to their closest grocery store, 30% of Minnesotans have low retail access to healthy food, especially in rural areas—for many, living in farm country does not equal easy access to fresh produce.

In the Twin Cities, almost one million people live more than a mile from retail access to food.[9] In the City of Minneapolis, there are 11 Federally Designated Food Areas, with communities with a high percentage of people of color, such as Near North (86%) and Camden (56%) being particularly affected by the lack of access to food.[10] However, an even bigger barrier to healthy food consumption is cost. Poor health outcomes are more strongly linked to poverty than to distance to a healthy food retail store.[11]

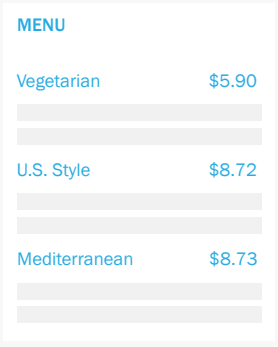
While it is not impossible to eat healthy on a budget, highly processed foods with high caloric density can seem to be the more cost-effective choice, even as they lack nutritive value. In general, grains and sugar food groups are cheaper than vegetables and fruits per calorie.

A 2019 study examined the three Healthy Food Patterns identified by the US Department of Agriculture (USDA) to implement its dietary guidelines for Americans, and found significant cost differentials compared to what many households are actually able to spend on a meal. The cost of existing diets was $5.47 a day for Hispanics, $5.48 a day for African-Americans, $5.94 a day for whites and $6.57 a day for Asians. By contrast, the recommended meal patterns suggested by the USDA are as follows: the US-style Pattern costs $8.27/d, the Vegetarian Pattern costs $5.90/d, and the Mediterranean Pattern costs $8.73/d. Further, the Healthy Food Patterns featured some of the recommended food groups in unrealistic amounts, increasing soy by 1600% in the vegetarian pattern, for example. Such deviations from commonly accepted eating behaviors further complicate the uptake of the guidelines by the population.[12]

How affordable are USDA Dietary Guidelines?



Hispanic + African-American Daily Meal Budget



Daily cost of USDA suggested meal patterns

Urban Agriculture: Why It Matters

The future of food is a question of global scale. According to the World Resources Institute, if we continued the status quo of our existing global food system, there will be a 56% production gap to feed the projected 10 billion people that will live on our planet in 2050. We would need land nearly twice the size of India in addition to the land we already use to close this gap. On the other hand, if we reduced the amount of meat and dairy that we consume and the food we waste by a half, then we can feed the world 80% organically without increasing the amount of farmland currently used.

Which one of these two scenarios will materialize will largely depend on how cities, home to the majority of the world's population, chose to respond at their local scale. Making the reduction of food waste a priority, increasing the land available for urban farming (including the reuse of buildings for indoor production), and investing in regenerative practices are some of the tools available for cities to lead this transition. While urban farming alone is not a panacea to the myriad of problems inherent in the centralized and industrialized food system, it can add resilience, access to healthy foods, and community wellbeing to cities, as well as deepen a sense of shared purpose and identity.

2 Food: A Tale of Misallocated Resources

According to the latest data available from the USDA, in 2018 more than 37 million people in the United States lived in food-insecure households, including more than 11 million children.[13] The USDA defines food insecurity as "lacking access to enough food for an active, healthy life for all household members at least some time during the year." In 2018, levels of food insecurity declined to the pre-recession (2007) level of 11.1 % of all households only for the first time, indicating that the effects of the Great Recession could be felt in American households for over a decade.[14] Estimates of total direct and indirect 2014 health-related costs attributable to food insecurity amount to $160 billion annually in the United States.[15]

In 2017, 128,620 residents in Hennepin County were food insecure (10.4% of the population), of which 34,160 were children (12.6% of children[16]). At a cost of of $3.43 a meal, Feeding America estimates there is a collective food budget shortfall of $75 million per year.

Although food insecurity rates in Hennepin County and in Minnesota have both been trending downwards while consistently being lower than the national average over the past decade, visits to food shelves tell a different story. According to an analysis of state data by Hunger Solutions, the number of Minnesotans using food shelves hit a record high in 2017 with 3,402,077 visits, making 2017 the seventh consecutive year of more than 3 million yearly visits.[17] Both at a local and national level, even as unemployment has fallen, and before the COVID-19 pandemic, households have begun using emergency food assistance programs as a regular way to meet their food needs. This indicates that for many, wages are not enough to cover all basic needs, such as food. One study estimates that in the United States, more than 53 million people—44% of all workers aged 18-64—are low-wage workers, earning median hourly wages of $10.22 and median annual earnings of $17,950. In the Minneapolis-St. Paul-Bloomington statistical area, by the study's measures, 35.3% of the workforce are low-income earners.[18]

2.1 The Generational Ripple Effects of Hunger

Both in Hennepin County and the United States, children are affected by food insecurity at higher rates than the general population. Seen through a restorative lens, this is a liability that we carry forward with compounding effects on future social and physical wellbeing. Surveying peer-reviewed studies offers a picture of the estimated healthcare, special education, and lost work time expenses attributable to food insecurity. In Massachusetts, a state that is comparable to Minnesota in terms of population and food insecurity rates, a study put that figure at $2.4 billion for the state in 2016. Of the $2.4 billion, about $1.9 billion were direct and indirect health-related costs, and special education accounted for $520 million in expenditures.[19] As a reference point, a similar 2010 study put the cost of hunger in Minnesota at $1.3-$1.6 billion annually.[20] When putting the low range of this estimate against the $260 million food budget shortfall in the state, every dollar invested in filling the food budget gap would yield five dollars in future health and social benefits.[21]

Annual Cost of Misplaced Resources in Food (United States)

$162B
Food wasted along food supply chain[1]

+

$160B
Healthcare costs due to food insecurity[2]

=

$332B
Total cost of misplaced resources, not including environmental costs

[1]USDA; [2]Children's Health Watch

2.2 The Impact of Food Waste

If waste is a resource in the wrong place, perhaps no other resource is more misplaced than food. According to the United Nations, if food waste were a country, it would be the third-largest global greenhouse gas emitter following the United States and China.[22] The food that is lost either during the supply chain or in households consumes about one-quarter of all water used by agriculture each year and requires land the size of China to be grown.[23]

Every year in the United States, approximately 31% (133 billion pounds) of the overall food supply is wasted, with an estimated retail value of $162 billion.[24] Expressed on a per capita basis, food loss at the retail and consumer levels in 2010 totaled 1.18 pounds of food per person per day, with a retail value of $1.43. In today's dollars, this means a city the size of Minneapolis loses $719,000 every day in food.[25] This is more than three times the daily amount needed to lift every resident in Hennepin County out of food insecurity.[26]

2.3 The Business Case for Reducing Waste

The United Nations have set the following Sustainable Development Goal: To halve per capita food waste at retail and consumer level by 2030 and to reduce food loss in agriculture and processing. In developed countries, contrary to developing countries, food waste happens primarily during consumption, not during production. A study called *The Business Case for Reducing Food Loss and Waste*[27], whose authors include leaders from the World Resources Institute and the London Waste And Recycling Board, a pioneer in urban circular economic development, presents multiple calculations for food waste savings at the national, city and business level. In 2012–13, six West London boroughs implemented an initiative to reduce household food waste, resulting in a 15% reduction. For every £1 invested in the effort, the local government saved £8 in waste management and disposal costs. When the financial benefit calculations were extended to include benefits to households, £92 were saved in total per £1 invested.

Similarly, for companies, the return on investment in food loss and waste reduction can also be high. In a survey of more than 700 international companies, representing a range of sectors including food manufacturing, food retail, hospitality, and food service, for every $1 invested in food loss and waste reduction, the median company generated a $14 return.[28]

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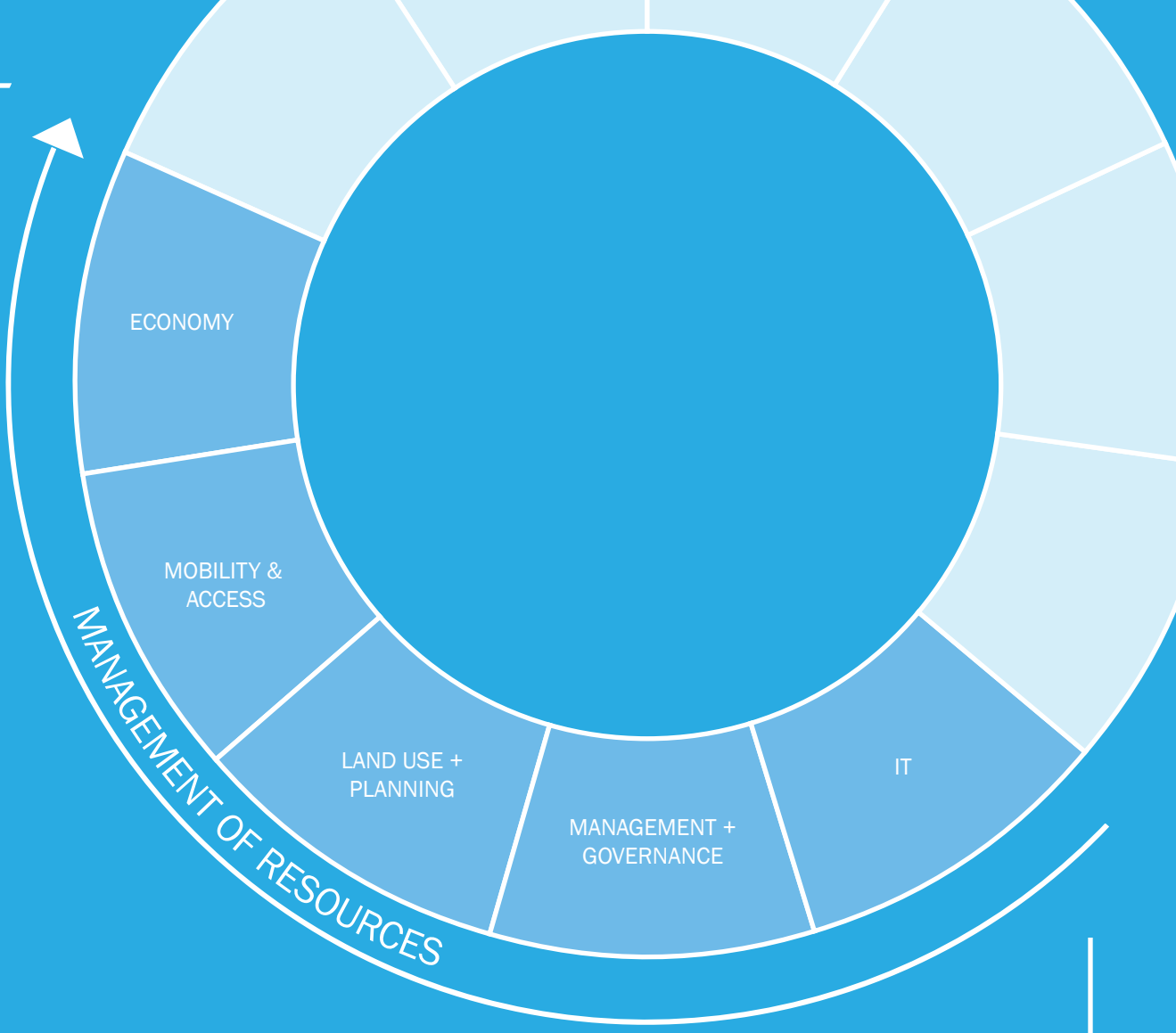


2.3 Building equity

Management of Resources

2.3 Section Overview

After having built an understanding of our city's and region's assets and resources (water, energy, materials and food) this section explores resource management, meaning:

Are we effectively managing our assets and resources to create desired outcomes, such as health and wellbeing?

KPIs for Resource Management are:

- **Information Technology, Smart City & Artificial Intelligence**
- **Land Use & Planning**
- **Mobility & Access**
- **Economy**

In the following chapters, we ask

- What systemic challenges and historic legacies carry ongoing costs and liabilities that lead to the loss of equity?
- What are the consequences of these costs and liabilities for people, businesses and communities?
- What future risks are not yet accounted for?
- How can restorative development address these challenges?

2.3.1 INFORMATION TECHNOLOGY

Minneapolis has a good and reliable internet infrastructure and mobile networks with high-speed options, which were first developed in more affluent neighborhoods and business/finance districts downtown before expanding to the rest of the city. Minneapolis also offers an outdoor internet network for residents and visitors that covers almost the entire city.

The cost of high-speed internet can be prohibitive for low-income communities, which impedes their access to this vital 21st-century resource. This disparity has been exposed during the COVID-19 crisis where low-income communities had a difficult time connecting to online classes. In response, the city worked with private internet providers to offer low-cost internet options to residents.

A "smart city" strategy to monitor and optimize all resource flows, including water, energy, materials, and food, as well as smart transportation infrastructure, including drone infrastructure, has not yet been conceived or implemented. The increase in commercialization of artificial intelligence (AI) and automation and its impacts on employment and wealth distribution poses a threat that Minneapolis, like many cities, is not yet prepared for.

2.3.2 LAND USE

creating connectivity through inclusion, proximity & beauty

Seen through a restorative development lens, how we use land—and the equitable interplay between various uses—is the single-most-important factor in what makes or breaks the urban quality of life. Unfortunately, decisions that were made decades ago reverberate throughout the present with many mistakes of the past leaving deep scars in the urban and social fabric of Minneapolis today.

1. Inclusion

From the 1930s onwards the practice of redlining entire neighborhoods to inform lending practices, and later, the proliferation of racial covenants that forbid sales of homes to certain demographics, instilled racial discrimination into the DNA of neighborhoods in a way that is still visible today. To a large extend, these redlined maps read like a blueprint that reproduces itself on many of today's maps showing disparities in homeownership, income, health, educational attainment in Minneapolis neighborhoods.

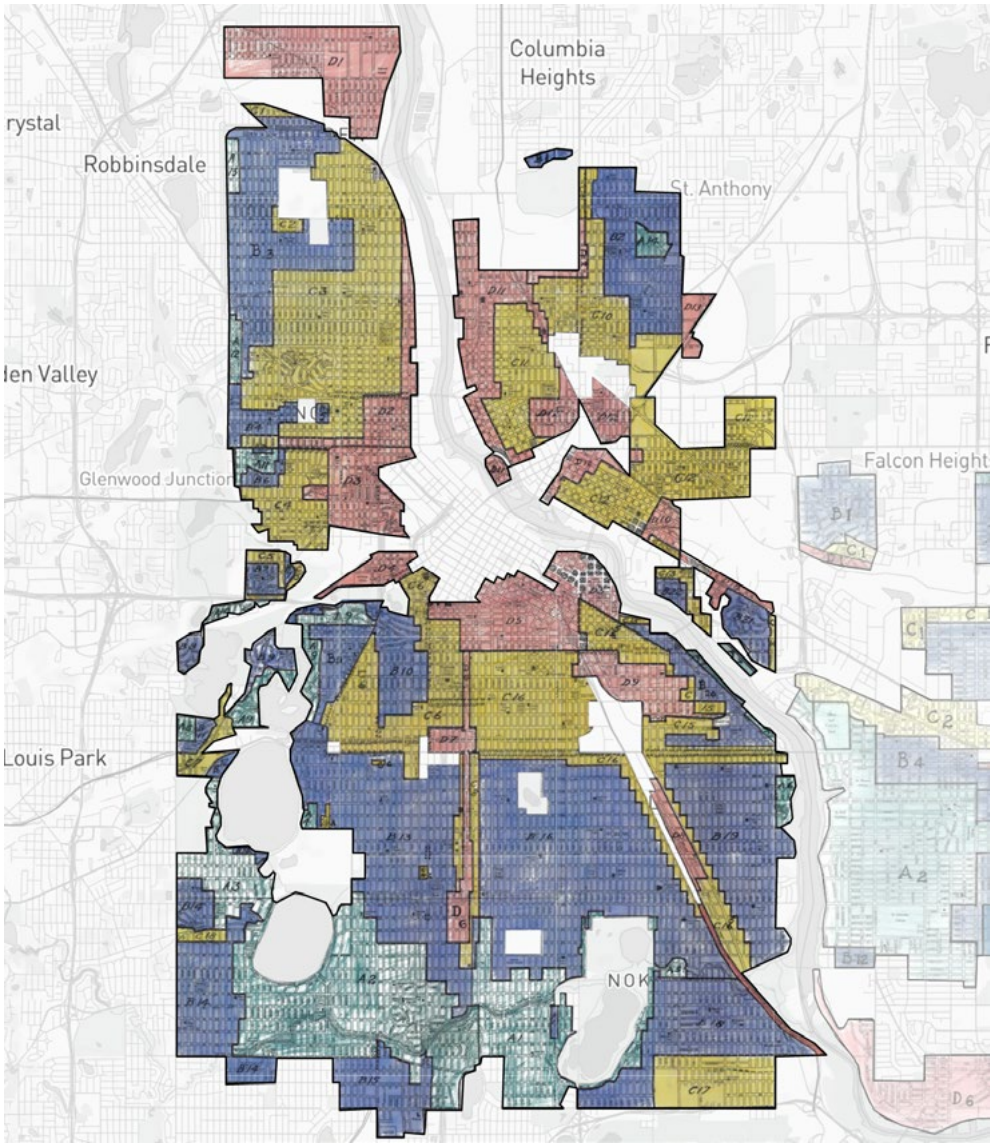
Redlined neighborhoods were considered prime candidates for highway construction and other projects of "Urban Renewal." In the 1950s, the construction of I-94 connecting Minneapolis and St. Paul tore apart thriving, self-sustaining neighborhoods such as Rondo in St. Paul. Rondo was a community that was home to most of St. Paul's African-Americans, before many residents were displaced to areas such as North Minneapolis and East St. Paul without the ability to bring along the social fabric and upward mobility that sustained Rondo. Decades later, in the 1980s, new highways tore through these communities as well, creating barriers between North Minneapolis and downtown that still loom large today.

These policies and land use practices, as well as many others that played out at the national and local level, created a de facto segregation by zip code. In a landmark 2019 study, researchers showed to what extend growing up in a particular census tract influenced a child's success in life, compared to a similarly poor child in a different census tract. For example poor children growing up in the Minneapolis Harrison neighborhood are expected to make $25,000 in their adult households, whereas poor children from the neighboring Bryn Mawr neighborhood are expected to make twice as much, at $51,000 per household.[1]

As *The New York Times* put it:

"The researchers believe much of this variation is driven by the neighborhoods themselves, not by differences in what brings people to live in them. The more years children spend in a good neighborhood, the greater the benefits they receive. And what matters, the researchers find, is a hyper-local setting: the environment within about half a mile of a child's home."[2]

Minneapolis Redlining (HOLC) Map, 1934



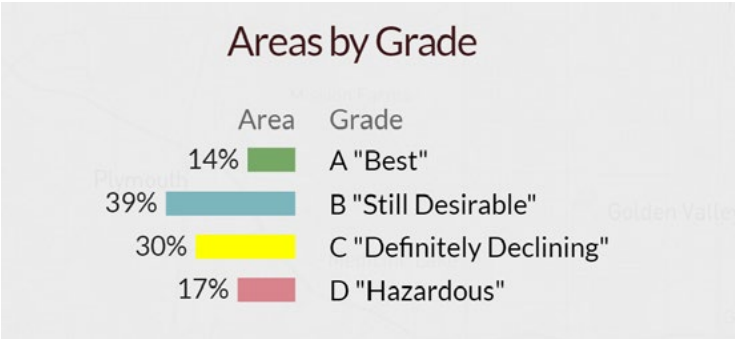


Image: Retrieved from *Mapping Inequality*[4]

2. Proximity

The second legacy of historic land-use decisions is the fractured, car-dependent character that is not only felt in the metro area but even at the neighborhood levels. Minneapolis neighborhoods that may have once had characteristics of a self-contained urban village are no longer safe or pleasant to traverse on foot or by bike, even in affluent areas. Rarely are children able to walk to school or parks by themselves, requiring the addition of a $50 million school bus expense to the city's budget. Senior living is often isolated in gated communities or, for more affordable options, is relegated to land near highways or other areas on the outskirts of the city. Large areas of land are used for surface parking or for commercial activities, bisecting neighborhoods in ways that require motorized mobility. Often large sections of land within neighborhoods are occupied by low-wage employers forming clusters in areas that already suffer from economic distress. Although the city no longer requires parking spots for new developments, it comes at a time where other key elements that are needed for car-less living are not in place.

Principles of regenerative urbanism call for safe and healthy proximity between key institutions such as schools, senior care facilities, health care, and religious institutions, sports and recreation, grocery and other businesses and services.

Urban planners and local governments recognize the need for greater density and proximity, and "Complete Neighborhoods" are championed as one of the main goals of the Minneapolis 2040 comprehensive plan. As they seek to undertake the difficult task of changing the historically grown structures of the urban landscape, they need to ensure accessibility to spaces for "live, work and play" exists for all people of all generations and socioeconomic status, including children and seniors.

When this proximity is lacking for most residents, new multi-use developments designed to achieve a neighborhood feel tend to serve a particular demographic, such as young professionals, and continue to act as non-local 'destination stops' for everyone else, ensuring the continued use of cars as the preferred and safest way of travel within the city. The lack of proximity further exacerbates social and economic disparities.

For example, amongst people who don't own cars, more blacks than whites live in poverty, indicating that if owning a car is a lifestyle choice, it is more likely one made by whites.

The Restorative Mindshift

The lack of proximity of institutions and businesses to live, work, and play is perhaps the single-most-important barrier to social cohesion and greater quality of life for all residents. For example, many parents spend hours per week driving their children to and from after-school activities, adding stress and pressure to roads, traffic, and family time. While this may be the chosen way of life for many mid- and upper-income families, many parents in the lower-income brackets are not able to drive their kids to after school activities due to long work hours. This risks deepening social exclusion for children and adults alike and acts as a barrier for social integration and equality in the city.

Looking at other countries offers valuable perspectives. In Iceland, for example, schools and after-school activities are built into each neighborhood in such a way that no child needs to cross a major road. Children in Reykjavík usually do not have to travel more than half a mile to school. A study shows that 84% of school children in Reykjavík, including those of elementary age, walk or cycle to school and after-school activities, even in winter.[5]

3. Beauty

Cities are a panopticon of the human experience, holding the promise of connection and happiness alongside the specter of isolation and despair. Emerging research that links how cities affect mental health suggests that living in a city can increase mood disorders, anxiety disorders, and the risk of schizophrenia; yet it can also decrease the risk of suicide, dementia, and Alzheimer's disease.[3] The degree to which one experiences connection or, conversely alienation, is largely determined by land use and urban design practices. In addition to inclusion and proximity, beauty—which can be broadly defined as a harmonious integration between architectural and natural forms—plays an important role in the wellbeing of residents.

Like many American cities in the late 19th and early 20th century, Minneapolis and its downtown were once home to many architectural jewels. Aesthetic forms and details were ingrained into the built environment as an expression of civic pride during a time when the creation of beauty was a valued public good. In the 1960s and 1970s, large swaths of downtown gave way to a new, more utilitarian building style, as well as a significant increase of surface parking lots. Today, the revival of the North Loop with its historical warehouse architecture offers a glimpse of what was lost, revealing an enduring, perhaps even timeless beauty that seems to have outlasted the futuristic utilitarian architecture of the 1960s and 1970s that now dominates much of downtown.

With regard to natural areas, Minneapolis was home to pioneers of urban park design and managed to preserve a world-class park system to this day (Minneapolis and St. Paul regularly trade top spots on the Trust for Public Land's national ranking for best park systems). While the Minneapolis Park and Recreation Board (MPRB) has managed to preserve and expand the park system and is focused today on ensuring inclusion and equity, access to green space is somewhat limited by the car-centric surrounding urban infrastructure. Parks are often destination points that are not integrated into communities through safe walk and bike paths, making them an underutilized asset for many populations.

Beyond the formal park system, blue infrastructure—the integration of water into the public realm—is underdeveloped within communities. The Mississippi River and its riverfront are largely underutilized, and past land use and urban design practices caused streams and wetlands to be hidden to make space for development. Likewise, urban agriculture, although championed by many non-profit organizations and explored by MPRB for its parks, is not yet integrated into public spaces on a significant scale or as a part of a larger comprehensive strategy.

Parks, plazas, and other attractions such as water features and public art, are not a part of the typical neighborhood design in Minneapolis or the region. Similarly, biophilic design is not systematically planned for or measured as a part of city development. As the integration of nature, art, and beauty into the public realm is gaining momentum in cities across the world, Minneapolis stands to gain much from creating more physically attractive neighborhoods to live, play and work.

2.3.3 MOBILITY & ACCESS

towards people-centered connectivity

Historic urban sprawl and the subsequent development of a car-centric culture in the United States is deeply ingrained in the fabric of today's U.S. cities. This has lead to a historic approach to mobility centered on the built environment. Today, cities like Minneapolis face the challenge of transitioning to a "people-centered" approach to mobility that prioritizes equal access and equity.

1. Car-Centric Commutes

In Minneapolis, residents spend an average of 25 minutes commuting to work, or 50 minutes each day, the 4th best amongst metropolitan areas in the country[6]. However, in 2017, the last year measured, additional traffic delays have reached an all-time high of 56 hours per person per year, putting the cost of congestion for each resident at $1100 in lost time and additional gas money.[7] All in all, Minneapolis residents spend a little over 250 hours each year on their commutes, which equals more than 6 workweeks. However, what was accepted as an inevitable part of life before the pandemic no longer seems so self-evident or desirable, as people working from home are discovering an additional hour of stress-free time every day.

The desire to reduce car commutes predates the pandemic. A city survey of approximately 5,000 residents from 2018 shows that about 50% typically commuted by car, however, when asked about their preferences for commute or mobility, every category (transit, biking, walking, ride share, car share, and other) saw an increase as a desired travel mode, except for the private car.[8]

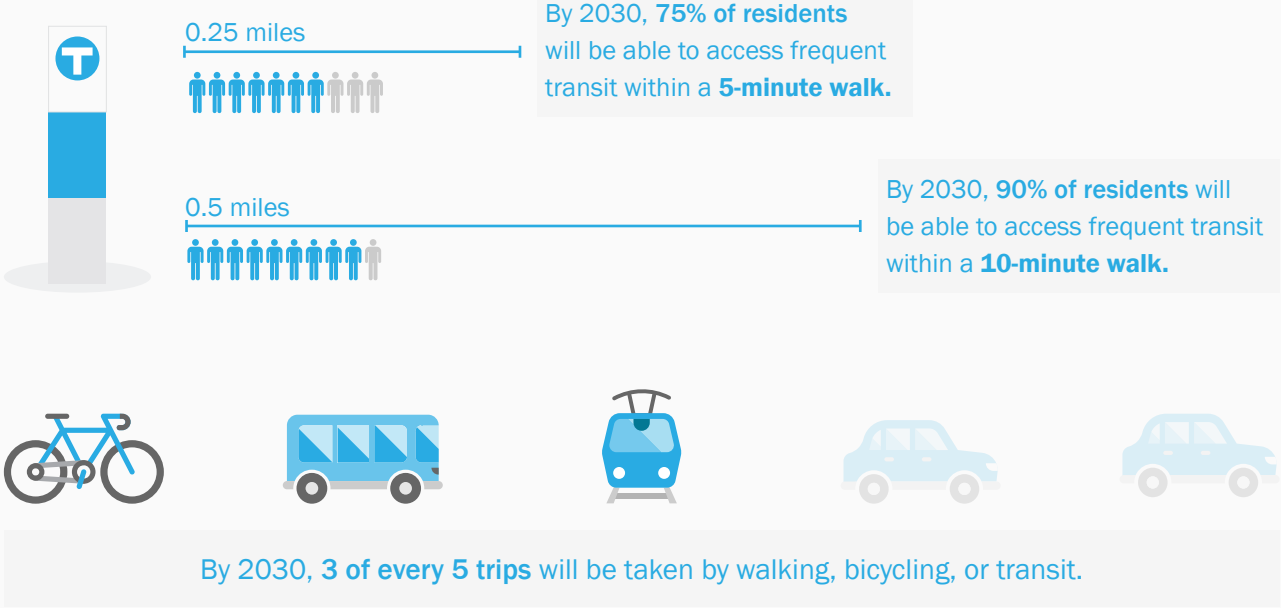
Following efforts to reduce traffic, vehicle miles traveled are down 2% in Minneapolis between 2007 and 2016, even as the city gained roughly 30,000 residents.[9] This is a consequence of new residents moving to dense areas, where new apartment buildings serve as urban infill, and of investments in public transit and bike infrastructure. However, Minneapolis's climate goal is to reduce total miles driven in the city by 40% by 2050, even as the metropolitan region is expected to gain more than 800,000 new residents by 2040, potentially adding more than 675,000 personal vehicles to metro area roads.[10]

Currently, approximately 47% of Minneapolis residents have a quarter-mile access, or about a 5-minute walk, to a high-frequency transit. The Draft Transportation Action Plan (TAP) has set a 2030 goal of 75% of city residents located within a quarter-mile and 90% of residents located within a half-mile walk of high-frequency transit corridors.[11]

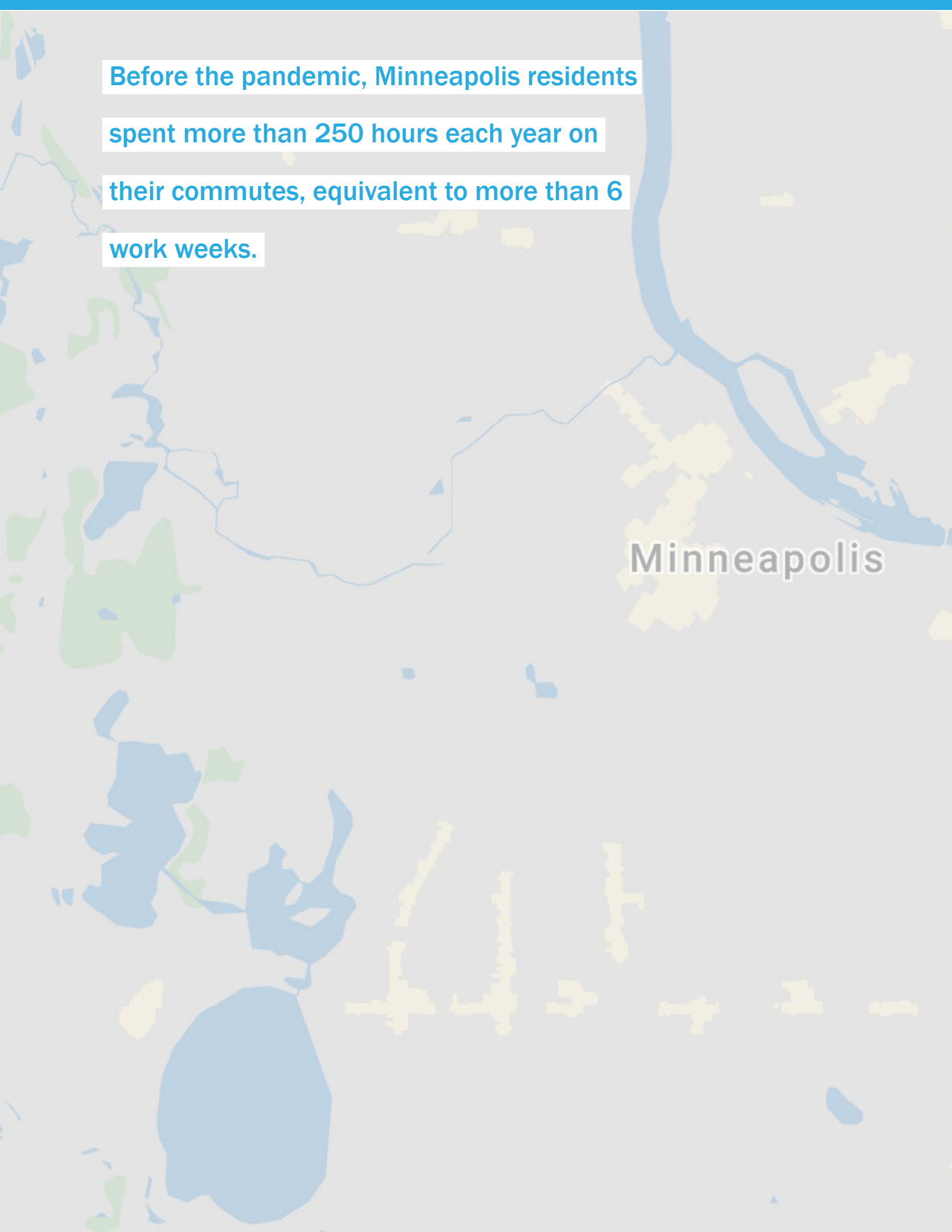
By 2030, the plan sets a goal that 3 of every 5 trips be taken by walking, bicycling, or transit.

Reaching these ambitious goals will require a concerted, holistic effort, not only focused on infrastructure and transit but also on land use, urban design, and the strengthening of hyper-local economies, where technical and vocational training and work can take place in the neighborhoods where people live. Local resource management offers opportunities for shorter work commutes, and less truck traffic coming from the transportation of goods and waste management.

Key Targets of the Draft Transportation Action Plan



Before the pandemic, Minneapolis residents spent more than 250 hours each year on their commutes, equivalent to more than 6 work weeks.



2. Existing Infrastructure

Within Minneapolis, there is an extensive transportation system that includes networks of streets, sidewalks, bikeways, and transit routes that offer people many options for getting around. The City of Minneapolis owns and operates some, but not all, of this transportation system. According to the Minneapolis Draft Transportation Plan, there are:

- 1,062 miles of streets and 394 bridges (Minneapolis owns 107 of the bridges)
- More than 2,000 miles of sidewalks
- 150 miles of on-street bikeways and 105 miles of off-street bikeways and trails
- 811 traffic signals, operated and maintained by the City of Minneapolis
- 207 local transit routes and 11 high-frequency transit routes
- Many street trees, boulevards, and public spaces

Although Minneapolis is considered one of the most bikable cities in the United States and has a relatively high walk score of 70, it does not compare favorably with international cities. Biking and walking are not safe choices for most people for most trips, with cars being the default option. There are still many hazardous roads and intersections, poorly managed side and crosswalks, and a lack of safe passage through tunnels and bridges.

As it stands, the existing system is expensive to maintain, with few resources left to change infrastructure at a more fundamental level. For example, state-wide, the Minnesota State Highway Investment Plan (MnSHIP), published in 2017, estimates that state roads are underfunded by $17.7 billion over the next 20 years, which equals an annual funding gap of $885 million. Without significant public investment, the state and local roads and bridges will continue to fall into disrepair. (The 2018 Report Card for Minnesota's Infrastructure by the American Society of Civil Engineers gives the state's roads a D+, Transit a C- and Bridges a C.)

Taking a long view, knowing that foundations need to be put into place today, restorative development challenges urban planners to rethink the concept of proximity more deeply and think beyond mixed-use developments that combine retail and residential and tend to serve young professionals. It calls for creating intentional proximity between institutions (schools, senior living, places of worship) and amenities (grocery stores, parks, etc.) which must be connected by blue and green infrastructure that is walkable and bikable. With ride-share apps and electric scooters at their disposal, young professionals can already make the choice not to own a car. When this becomes possible for families and senior citizens as well, true restorative development is taking place.

Left: A view of Minneapolis showing bodies of water, park land and "areas of interest" (yellow) as defined by Google Maps. How would today's planners rethink connectivity if they could go back to the drawing board?

3. Transportation and Equity

Transportation is one of the top two household costs, accounting for approximately 19% of household income in Minneapolis.[12] During the drafting of the Transportation Action Plan, one common feedback received through its engagement with the community was that free transit fares, lower transit fares or more affordable transit were desired by most people as the current transit fares were considered a barrier for many individuals.[13]

Car-centric cities have high traffic accidents and fatalities. Every year from 2007-2016, an average of 95 people either died or experienced a life-altering injury on Minneapolis' streets.[14] These injuries are disproportionately suffered by those walking and bicycling in lower-income neighborhoods, and by the Native American population.[15] In 2017, the City adopted a Vision Zero Policy and in 2019 the City Council passed the 2020-2022 Vision Zero Action Plan, which commits to zero traffic-related fatalities and severe injuries by 2027. Through these actions, Minneapolis has unequivocally committed itself to improve safety on the streets for all people regardless of income, race, or age.[16]

Although multiple levels of government—cities, the Metropolitan Council, and the state, are taking significant actions, such as building neighborhood mobility hubs; the real challenge of the next decades—with first action steps needed today—consists of finding new models within neighborhoods that can create proximity and equitable access to ecosystems of work, live and play for all, not just for those for whom not owning a car is a lifestyle choice facilitated by the ability to live in upscale, mixed-use developments.

Today, not owning a car is mostly a function of income, not choice. As such, income inequalities and inequities have an impact on car-ownership, and by extension, access to opportunities. African-Americans and people of color are more likely to live in households that do not own cars. In Minneapolis, 31% of people of color did not own cars compared to 12% of whites in 2017.[17]

Land-use practices that force car ownership as a condition for access to jobs and services are by definition inequitable, allowing those who have a personal vehicle to build equity, while those without continue to lose equity.

A restorative city is an accessible city. It provides a coordinated network of emissions-free, safe, and easy to access mobility options such as separated sidewalks, lanes, and trails for walking and bicycling and it supports electric hydrogen, and biogas filling stations for zero-emission vehicles. (With regards to low-emission vehicle adoption, currently, just 2.4% of the cars, buses, and trucks in Minneapolis are hybrid or electric. It is estimated that by 2040, 55% of all new car sales will be electric.[18] No plans appear to exist to introduce fuel cell technologies in public transit or school busing.) In restorative development, placing jobs within neighborhoods, and providing low-cost, emission-free public transport ensures equal and equitable access for all. It understands that every hour saved in traffic can be an hour invested in child development, elderly care, or personal health and wellbeing; time that today is severely lacking especially for low-income families.

African Americans have access to 31% fewer jobs requiring an associate degree or less, on average, via a 30-minute transit ride than whites.

A multi-city study on equity and mobility that included Minneapolis found that access to transit, in general, is equitably distributed amongst all income and racial groups, but that access to quality transit—frequent service to key destinations—is not equitably available.[19] According to this study, African Americans have access to 31% fewer jobs requiring an associate degree or less, on average, via a 30-minute transit ride than whites, even as they disproportionally depend on such jobs for their livelihoods.

In Minneapolis, only 5% of jobs requiring less than a High School education are accessible by transit, walking, or biking for workers within 30 minutes.[20] 23% of such jobs are accessible within 60 minutes without a car. This means 70% of these jobs take longer than 2 hours each day to reach without a car.

Another measure indicates that 88% of all jobs are near frequent transit, meaning they are within a roughly 10-minute bike ride or walk of a frequent transit stop. However, this measure is of questionable usefulness, as having to combine public transit and biking is not practical for most people, not least because bike space on buses is very limited and cumbersome to use on the light rail.

2.3.3 MOBILITY & ACCESS

towards people-centered connectivity

In restorative development, access is defined not only in terms of access to geographical locations through physical infrastructure but also in terms of access to vital resources such as education, housing, and healthcare. Equitable and affordable access to these resources is the precondition for a productive workforce and flourishing inclusive local economy. When entire groups of people lack these resources, communities lose equity and resilience.

1. Education

Select indicators paint a stark picture of the disparities that exist in Minneapolis concerning access to education, homeownership, and health care.

Minnesota has the worst achievement gap in the nation. This hasn't always been the case. Minneapolis, once a model of integration where less than one percent of Black students attended highly segregated public schools (where 90 percent or more of the student body was not white), now has many more highly segregated schools. In 2018, a quarter of the region's Black students were attending highly segregated schools.[21] These schools tend to have fewer resources, less experienced teachers, and lower graduation rates, leading to lower rates of college attendance and lower income earning potential for those students. Studies have shown that in general Minnesota equitably distributes funding to districts that have a higher proportion of students in need, as measured by free and reduced lunch, with districts with mostly students of color receiving 8 percent more funding than predominantly white districts. However, schools that serve mostly poor, white students receive $509 more per student than poor, non-white school districts.[22]

There are many contributing factors to the achievement gap that are outside of a school's direct control, such as food insecurity, lack of family support, and the absence of summer learning programs. In addition to strengthening existing institutions and services, new ways of thinking are required to create new support systems to fill the gaps.

It takes a village to raise a child, and restorative development considers the role of neighborhoods—designed for inclusion, proximity, and beauty—to help raise a city's youth. Even in neighborhoods that cannot be built from the ground up, where blight, pollution, and gang violence have rendered streets unsafe, restorative hubs could serve as a safe space for learning and play, and act as a catalyst for change. For example, they could offer youth mentorship and training in connection with food production, energy generation, and manufacturing, including the preparation for vocational career pathways.

Creating more vocational and technical career pathways within neighborhoods is going to be essential in adapting to the structural change to come. Already, there is a misallocation of resources, where Minneapolis and Minnesota are experiencing a shortage of skilled workers, including technical labor, even as unemployment is high in some communities. With the increase in automation, even more people will find themselves out of work, with cities shouldering the social and socio-economic costs while corporations benefit from the gains. More than ever, neighborhoods need to serve as engines of the local economy, and they can do so through smarter management of resources, such as food, energy, water, and materials.

2. Homeownership

The increase in housing costs nationwide, but especially in growing cities like Minneapolis, has become a burden for many households while putting pressure on cities and their budgets. Over 57% of people of color and 47% of whites who rent in Minneapolis are cost-burdened, meaning they spend more than 30% of their incomes on rent.[23] In addition, in 2019, the city saw more than 10,000 people experiencing homelessness, a record high since 1990. This record was again broken in 2020 when the COVID-19 pandemic led to unprecedented growth in homeless encampments. At the time, Hennepin County officials estimated that it would cost $1 million per week to house and protect the homeless from COVID-19 exposures, and in late 2020, $22 million were allocated to six new facilities.

By 2040 the population of Minneapolis is projected to be 485,000 people[24], an increase of 50,000 people from 2019 levels. The seven-county Minneapolis-St. Paul region is projected to gain 893,000 people by 2040.[25] In addition to the existing shortage of housing supply, other trends are decreasing the availability of affordable housing: nationally, the fastest rise in home prices is at the low end of the market, removing affordable options. At the same time, the labor shortage in the construction market and a rise in material costs have increased the cost of building, making the development of new housing only financially attractive at the upper echelons of the market.

Today's renters are at a historical disadvantage: Since 1960, renters' median earnings have gone up 5 percent nationally while rents increased 61 percent. (For reference, homeowners earn 50 percent more while home prices have gone up 112 percent.)[26] Unfortunately, homeownership has also become harder to access, especially for some populations.

Since 1987, white homeownership rates have increased by 3.6 percent, while black homeownership rates have fallen by 2.7 percent.

Homeownership is the prime driver of the wealth gap between blacks and whites. Unfortunately, trends are pointing in the wrong direction. Since 1987, white homeownership rates have increased by 3.6 percent, while black homeownership rates have fallen by 2.7 percent.[27] Minneapolis-St. Paul has the largest homeownership gap in any metropolitan area in the nation. Blacks and African-Americans have a homeownership rate of 25.6 percent in Minneapolis compared to a much higher rate for whites at 76.8 percent, a gap of 51 percentage points[28] This is a direct reflection of historical patterns that prevented black Minneapolis residents from building intergenerational wealth, of today's significant income disparity, and of persistent structural barriers, such as reduced access to loans and mortgages.

A plethora of measures to increase housing affordability have been taken by the city and other levels of government, some of which caused heated debate. The Minneapolis 2040 Comprehensive Plan revolutionized single-family zoning to allow for greater density, and an inclusionary zoning ordinance requires developers to set aside a certain percentage of new units at affordable levels. Mayor Frey, for whom housing affordability is a priority, put forth $40 million in the city's 2020 budget to fund various programs in 2020, with a $7.2 million increase in ongoing funding pledged for 2021. While this is a historic high and places Minneapolis as a national leader, the city acknowledges that these investments need to be embedded in a larger effort of inclusive economic growth.

Restorative Spotlight: Affordable Housing

Rising income inequality and its effect of skewing the housing market towards high-income earners have a profound impact on the city's resilience as an ecosystem. As prices increase, service and other workers—many of whom have proven to be essential to our society's functioning during the COVID-19 pandemic, are no longer able to live near the place of their work. This displacement leads to sprawl, longer commutes, and less time spent at leisure or with family.

The increase of cost-burdened households has significant opportunity costs. According to an analysis of the National Equity Atlas, if all Minneapolis renters paid only what they could afford on housing they would have an extra $233 million to spend in the community each year, or $5,600 per household, which is more than an annual food budget. That amount would also be the equivalent of 77% of the cost of childcare or 52% of tuition at the UofM.[29] Bringing rents down to an affordability level (no more than 30% of income) would also be a significant step towards closing racial disparities, giving Blacks 20% more disposable income. (For reference, whites would have 5% more disposable income).

There is no single solution for an issue as complex as housing affordability, especially when the problem definition is equally complex: is the market working exactly as intended? Is it working too well, or not at all? Will increasing supply drive down rent, or will it drive developers and their investors to look for markets elsewhere? And is change possible in a system where governments are faced with limited funds, and developers spend multiple years patching together dozens of competitive tax breaks and grants to finance an affordable housing project? (According to some estimates, addressing affordable housing challenges in the Twin Cities region would require an investment of at least $1.1 billion in public funds, of which 30 percent would go to housing preservation and production, and 70 percent to direct subsidies to low-income renters.[30])

Restorative Development makes a case for not tackling affordable housing in isolation, but pulling levers at the system level, to create the "inclusive economic growth" that the City of Minneapolis is seeking to develop. Restorative development offers a pathway to creating 21st-century local economies that attract well-paying employers and providing career paths designed to graduate people out of publicly-subsidized housing. It looks to leverage public investment in restorative infrastructure as an incentive for the private sector to build for net-positive outcomes.

In Hawthorne-McKinley, 270 out of 1500 people (15%) don't have health insurance.

3. Health Insurance

Access to health insurance continues to be a challenge in the United States, and consequently in cities such as Minneapolis, even as the city scores a few percentage points better than the national average. In 2018, 67% of residents had private insurance, 34% had public coverage and 7% had no health insurance. In some neighborhoods, such as Hawthorne-McKinley, uninsured rates were as high as 15% in 2018. While this data does not exist on the neighborhood level, nation-wide research has shown most people remain uninsured either because of affordability concerns tied to the marketplace, or because of administrative burdens imposed by Medicaid and Medicare, especially during re-enrollment.[31] While Minnesota is a leader in increasing access, significant barriers still remain, especially in areas of concentrated poverty.

However, even in a system where health insurance is tied to employment, having a job is no guarantee for coverage: in fact, amongst those residents who are in the labor force and employed in Minneapolis, slightly more than the Minneapolis average—7.8%—have no insurance. (Another 14.5% has public coverage). This indicates that employment does not remove barriers to health insurance for those who work part-time, are entrepreneurs, or receive no benefits for other reasons. While local governments do not create healthcare policies, they have a vital interest in attracting employers that offer good benefits, as the consequences of underinsurance are felt community-wide at the local level.

Access to private health insurance is not a sufficient indicator of the financial burden posed by health care. A person earning just above the threshold for public assistance will likely experience considerably higher stress paying private insurance deductibles and out-of-pocket costs than someone who earns somewhat less but qualifies for public coverage. According to the Federal Reserve, almost 40% of American adults would not be able to cover a $400 emergency expense with cash, savings, or a credit card charge that they could quickly pay off.[32]

The Milliman Medical Index, which takes the position that healthcare costs paid by the employer would otherwise be paid in wages to the employee, estimates that the typical American family of four insured by the most common employer-sponsored health plan can expect to spend more than $28,000 on healthcare in 2019. Of this amount, $15,788 is paid by the employer; $7,674 is paid through employee payroll deduction, and $4,704 are out-of-pocket expenses.[33]

2.3.4 ECONOMY

growth through equity

In 2019, Minneapolis was listed as the 47th most livable city in the world and 10th in the United States, as ranked by the Economist Intelligence Unit's Livability Index.[34]

The economy in Minneapolis has long benefited from the city's proximity to a large number of Fortune 500 companies, as well as to many private businesses operating in diverse industries. Minneapolis-St. Paul ranks first in Fortune 500 Companies per capita among the top 30 metro areas.[35] Minneapolis also regularly shows up in top spots for rankings such as the healthiest city, the best place for women in the workforce, and the best place to retire.

However, these accolades belie a deeper, more troubling truth. While the Minneapolis-St. Paul placed 6th in median household income amongst U.S. metro areas[36], and Minnesota has the 6th lowest poverty rate amongst all states[37], it has some of the biggest disparities nationwide on both measures. Amongst all U.S. states, Minnesota ranks 49th in median annual income gaps and 48th in poverty rate gaps between blacks and whites.[38]

After the tragic and troubling events of 2020—a public health emergency that shut down the city's economy and disproportionally affected people of color, and the social unrest following the death of George Floyd in Minneapolis—the city is coming face to face with the toll of inequality. A new approach is needed to equitably revive the local economy, and consequently, increase community health and wellbeing, and create a sense of culture, identity and pride in the city that is truly shared by all residents.

1. Economic Inequity: Key Figures and Opportunities

Minnesota has one of the highest racial disparities in the United States. A recent study comparing the socio-economic characteristics of blacks and whites places Minnesota 45th in racial integration, 49th in homeownership rate gap, 48th in poverty rate gaps, 50th in percentage gap of adults with at least a high school diploma, and 45th in racial progress.[44]

The significant disparities in homeownership are one of the main barriers to building intergenerational wealth and equity for black Minnesotans. Minnesota's overall homeownership rate is 71.6 percent, one of the highest in the U.S. However, blacks and African Americans only have a homeownership rate of 25.6 percent in Minneapolis compared to a much higher rates for whites at 76.8 percent.[45]

While income for Minnesotans is ranked as the 6th highest in the Nation, when divided by race the numbers differ significantly. In 2017, the median income for a White household was $65,845, while that of a Black household was $40,165, or 61 percent of a white household's income. These disparities are more pronounced in Minneapolis, where the median black family income was $36,000 in 2018, compared to $83,000 for a typical white family.[46]

Since the last economic recession and despite a significant effort and millions in investment, our region has only narrowed the wage gap between white Minnesotans and Minnesotans of color by $840 between 2007 and 2017.[47] While there are other cities with equally low values, others have made more progress, such as Baltimore (+$4158) and San Francisco (+$6680).

This slow progress in wage growth for people of color takes place in a national context of wage stagnation for all low-income workers. Between 1965 and 2015, workers in the top 5 percent had their wages double from $70,000 to $145,000, while for the bottom 10 percent the wages increased only $5,000, from $15,000 to $20,000.[48]

The Business Case for Equity

The case for equity is strong: according to a study, Minnesota's GDP would have been $16 billion higher in 2011 if there were no racial disparities in income.[39]

Nationally, the numbers are equally staggering. In "The Business Case for Equity" the authors write:

"Minorities make up 37% of the working-age population now, but they are projected to grow to 46% by 2030, and 55% by 2050. Closing the earnings gap by 2030 would increase GDP by 16%, or more than $5 trillion a year. Federal tax revenues would increase by over $1 trillion and corporate profits would increase by $450 billion. By 2050, closing the gap would increase GDP by 20%. This is roughly the size of the entire federal budget […]"[40]

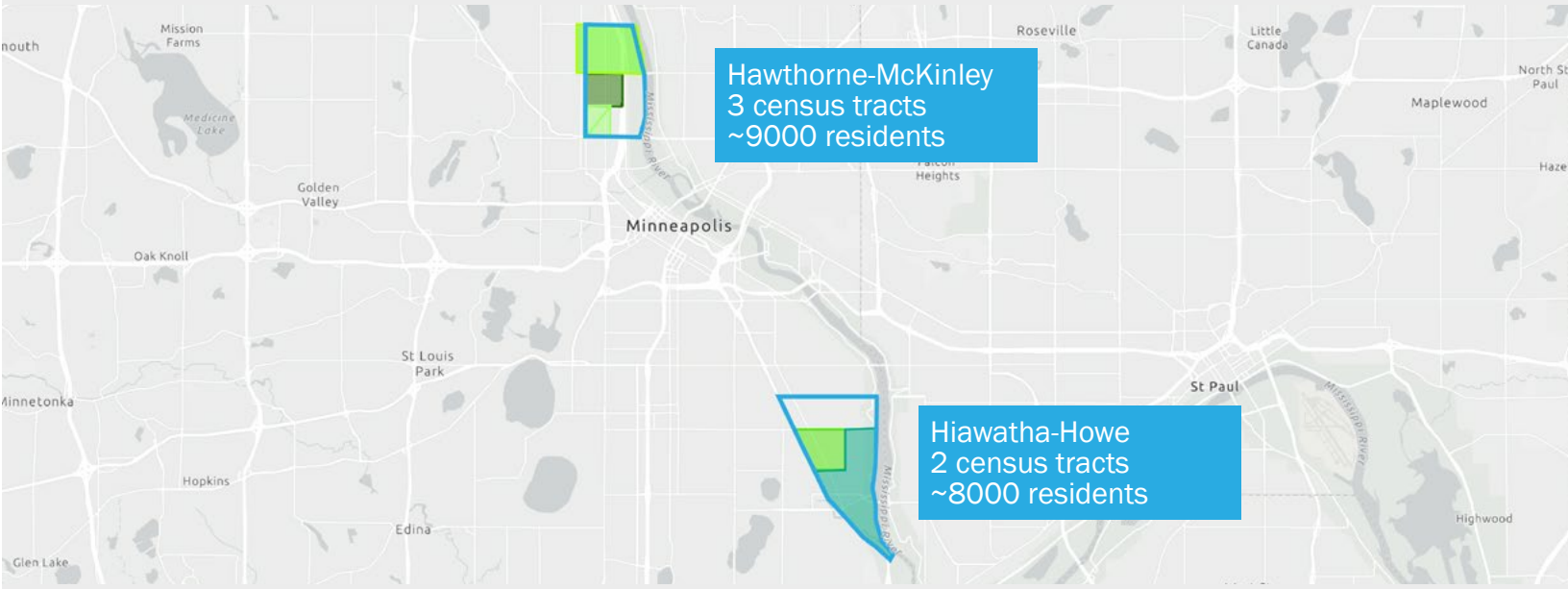
Closing the earnings gap in the United States would grow the national GDP by 20 percent by 2050.

While minorities represent about 22 percent of the Twin Cities metro population, minority-owned businesses represent just 7 percent of all employer firms.[41] According to the Center for Economic Inclusion, if the minority-owned business ownership rate was on parity with whites, an additional 87,000 people could be employed across the state.[42]

Lastly, the City of Minneapolis, like many economic hubs, will have to contend with a multitude of structural changes. The region is facing a talent shortage that is projected to worsen into the future, even as increased automation will eliminate jobs for those who are most economically vulnerable. Eliminating racial disparities represents as much as 70 percent of all opportunities to address the talent gap[43], while also increasing the workforce's resilience to weather deep structural economic change.

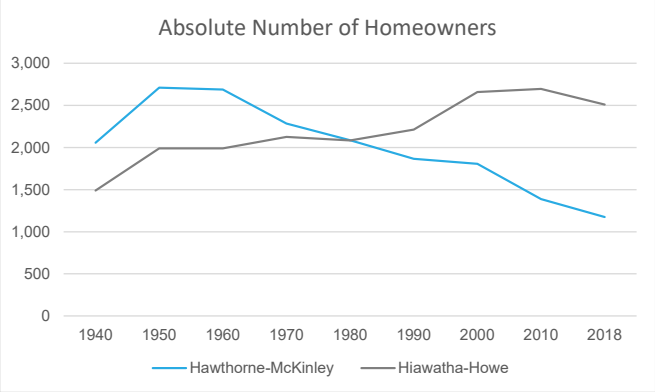
2. Case Study: A Tale of Two Neighborhoods

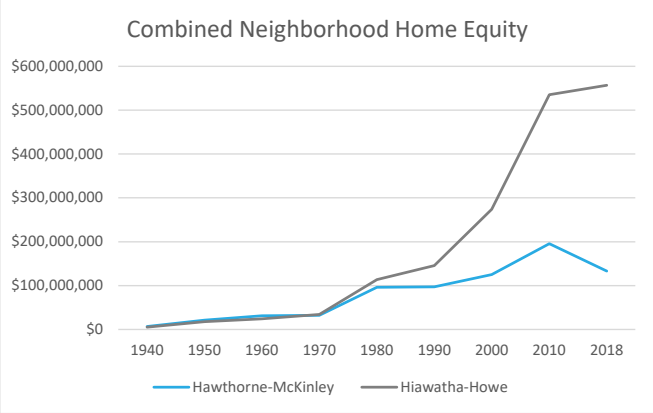
Comparison of historic homeownership, income and education levels in Hawthorne-McKinley (North Minneapolis) and Hiawatha-Howe (South Minneapolis) based on U.S. Census data from 1940 -2018.



2.1 Homeownership Equity Gap

Hawthorne-McKinley experienced a significant exodus of homeowners in the 1950s, 60s, and 70s. As a result, the neighborhood has lost an amount of potential neighborhood home equity that is larger than the combined home equity that exists in the neighborhood today.





- Note that Hawthorne-McKinley has had more homeowners for many decades
- In absolute terms, Hawthorne-McKinley homeownership has almost halved since 1950, due to population decrease, racial covenants, redlining, and other discrimination that prevented or failed to support new homeownership

- "Combined neighborhood home equity" describes number of homeowners multiplied by median home value
- Dramatic growth took place in Hiawatha-Howe in last 30 years
- Significantly slower growth registered in Hawthorne-McKinley
- Hawthorne-McKinley more vulnerable to downturns: 2018 home values similar to 1980s

Thought experiment: What would the combined equity be today if there were the same number of homeowners in each neighborhood as there were in 1950?

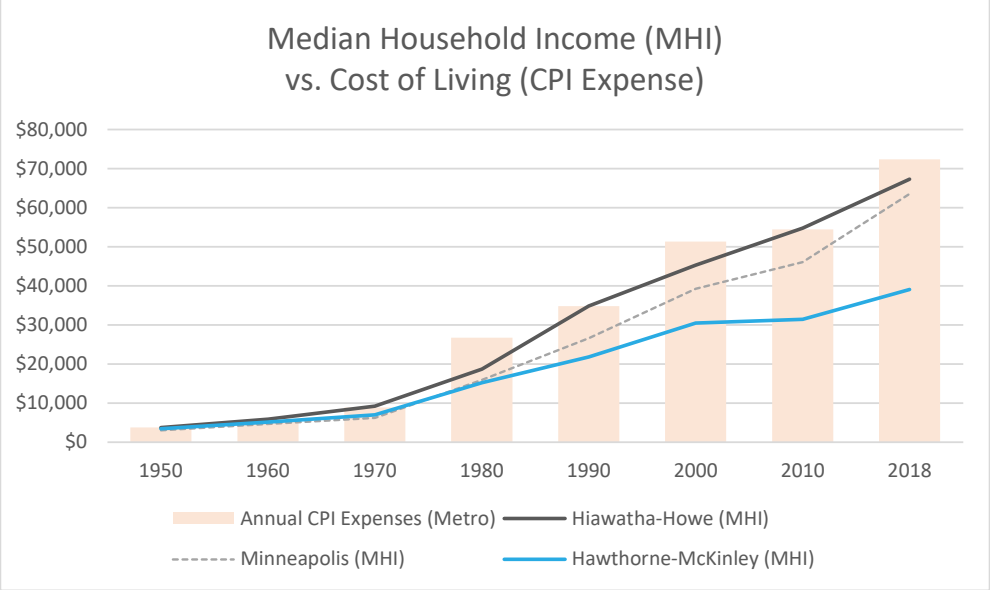
	Hypothetical equity*	Real Equity 2018	Equity Gain/Loss
Hawthorne-McKinley	$307,766,275	$133,278,350	$(174,487,925)
Hiawatha-Howe	$441,653,575	$556,780,750	$115,127,175

* Figure is based on number of homes owned in 1950 and today's neighborhood home values

The gap between Hawthorne-McKinley's hypothetical and real equity ($174M) is greater than its entire real neighborhood equity today. Further, this is based on today's lower home values in Hawthorne-McKinley; the real difference is likely much higher since higher homeownership rates generally lead to higher home values.

2.2 Quality of Life Gap

Economic inequality has widened to a point where it would take two household incomes for a Hawthorne-McKinley household to reach the average quality of life in the metro area. The quality-of-life gap for the neighborhood's 9000 residents is over $91 million every year. .



- In 1950, HMK median income covered 90% of expenses; today it covers only 54%
- Household incomes for a Hawthorne-McKinley household would have to double to reach the CPI metro area average
- This gap is partially covered by government aid, increasing household debt, etc.
- The "quality-of-life gap" for the neighborhood's 9,000 residents is over $91 million.

2.3 Education-Income Equity Gap

Disparities in incomes between neighborhoods are often perceived to be a result of different educational attainment. While this is true, it is only a part of the gap. If the college-degree graduation rates were brought to the same level as graduation rates in Hiawatha-Howe, an additional 1000 people would have to obtain a bachelor's degree in Hawthorne-McKinley. As a consequence, the district would realize additional incomes of $45M.

However, graduation rates are only a part of the equation. If in addition, income disparities between people with equal levels of educational attainment were also eliminated, another $50M of income would be available to Hawthorne-McKinley residents.

If this income disparity gap of almost $50M—which is largely driven by high school and associate pay disparities—was closed, it would be the equivalent of adding 250 fully-owned homes or 500 4-year college degrees to the "collective equity" in the district every year. Hypothetically, this would be more than enough to graduate every 18-25 year-old in the district.

Income by Degree: Gaps in Hawthorne-McKinley (HMK) Compared to Hiawatha-Howe (HH) - 2018

	Highest Degree Earned in HMK	Income in HMK	Individual Income Gap compared to HH	Collective Income Gap
High School Degree	32% | 1607 people	$22,255	($11,965)	($19,227,755)
Associate Degree	29% | 1464 people	$23,774	($16,953)	($24,819,192)
Bachelor Degree	11% |554 people	$41,831	($10,274)	($5,691,796)
				$(49,738,743.00)

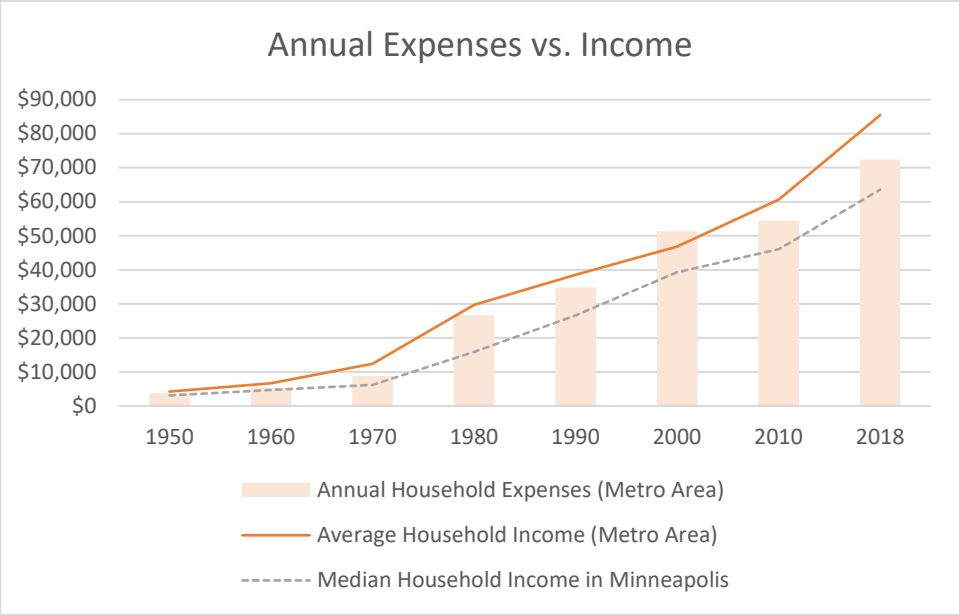
All data retrieved from the U.S. Census Bureau Decennial Census (1940-2010) and the American Community Survey 2018.

Read the full analysis at [Link to Google Doc]

3. Minneapolis: The Income Opportunity Gap

Traditional metrics, such as average area income, don't always tell an accurate story of the lived experience of many residents. Below is a different approach to offer a new perspective on collective equity gained and lost by residents and the local economy.

The Consumer Expenditure Surveys (CE) program provides data on expenditures, income, and demographic characteristics of households in the Minneapolis-St.Paul-Bloomington statistical area. The graph below describes the evolution of cost of living and affordability over time.



While expenses have risen at an increasing pace, the average metro household income has largely kept pace.

A gap begins to appear when we map the median Minneapolis household income against the average metro area expenses. While the mean household income is lower than the metro average, it does not reveal the extent of the opportunity missed by the city's economy and its residents.

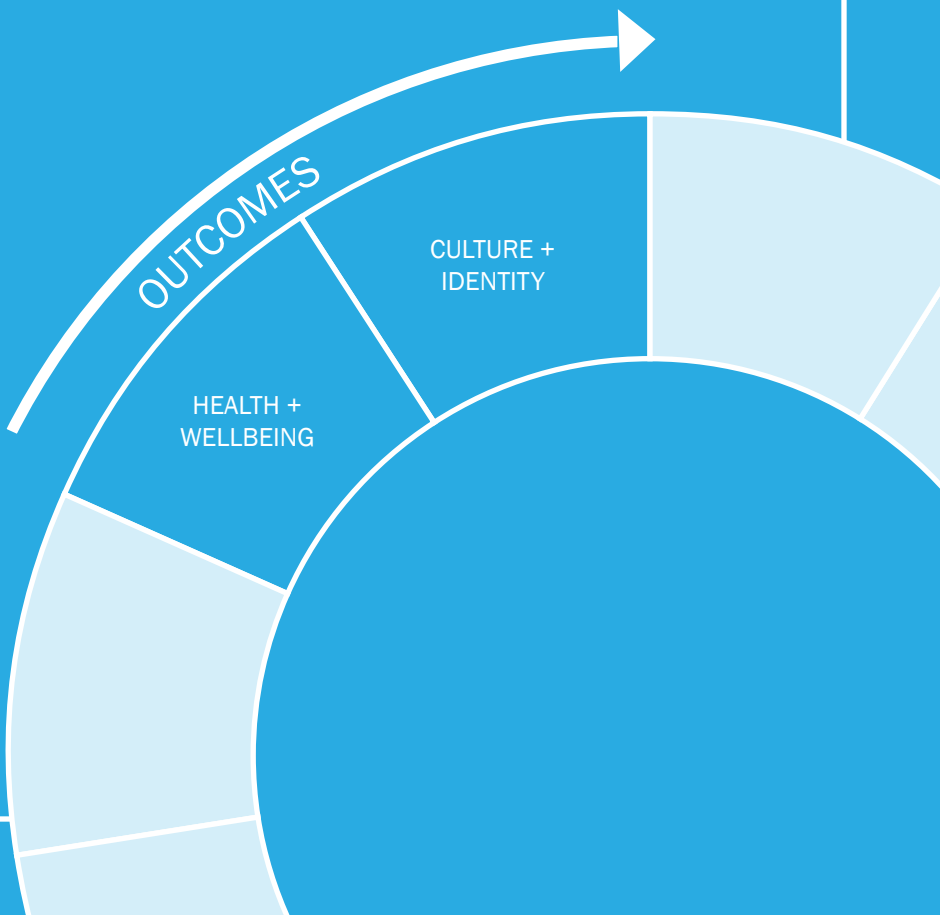
The gap increases dramatically when we consider the bottom 30% percent of households, who earn less than $35,000 a year. At this point, living expenses cannot be scaled back indefinitely, and liabilities likely accumulate in the system, such as an increase in household debt and public expenditures that make up for parts of the gap.

The table below illustrates the "standard of living" gap, meaning the combined amount that each percentile of low-income households is short of meeting the metro area average annual expense. It's a thought experiment that offers a glimpse into what is at stake: a total of 2.8 billion dollars. This figure describes the order of magnitude of the liabilities that are currently accumulating in the system, but also the social and city-wide economic opportunity of raising low-income earners to levels that approach the average standard of living.

Income	Percentage of Households	Total Number of Households	Combined Annual Income	Combined Expenses (Metro Average)	Standard of Living Gap
Less than $10,000	8.70%	15131	$151,306,920	$1,095,189,748	**$943,882,828**
$10,000-14,999	5.50%	9565	$143,471,135	$692,361,335	**$548,890,201**
$15,000-$19,999	4.40%	7652	$153,038,428	$553,889,068	**$400,850,640**
$20,000-$24,999	4.60%	8000	$199,995,400	$579,065,844	**$379,070,444**
$25,000 to $29,999	4.40%	7652	$229,561,468	$553,889,068	**$324,327,600**
$30,000 to $34,999	4.20%	7304	$255,649,216	$528,712,292	**$273,063,077**
				Total	**$2,870,084,791**

2.4 Designing for net-positive

Outcomes



2.4 Section Overview

After having built an understanding of our city's and region's assets and resources and resource management, this section asks:

What are the outcomes of the status quo, and how do we begin to envision a different future? What concrete action steps can we take today to work towards that future?

KPIs for Outcomes are:

- **Health & Wellbeing**
- **Culture & Identity**

Please note: In addition to examining the health of people and communities, this section has a heavy focus on the health of businesses. In restorative development, businesses exists inside of neighborhoods, serving as an important contributor to community health by providing career pathways and living wage jobs.

2.4.1 HEALTH & WELLBEING

a salutogenic approach

Neighborhood health, like the health of an ecosystem, is the expression of a complex interplay of a multitude of factors. At the most basic level, however, a neighborhood can only be as healthy as the sum of its parts. When residents experience a high prevalence of chronic disease, it impacts their physical, psychological, and even economic well-being. The resulting chronic stress impacts engagement and the ability to contribute to the community.

Of course, aging and its accompanying ailments are a fact of life: however, when chronic diseases are acquired because of social, economic, or environmental factors, they represent a liability that society still struggles to understand and quantify. Restorative development recognizes that a sick community cannot operate at a net-positive level, that disease causes individual and collective costs that need to be accounted for, and that we need to take a "salutogenic" rather than a pathogenic approach. This means a refocus on factors that support human health and wellbeing, rather than focus only on isolated factors that cause disease.

For example, we must stop accepting chronic stress as an unavoidable fact of modern life, and instead reexamine how our urban design and infrastructure, and our social and economic structures, contribute to its proliferation, especially in low-income neighborhoods. Restorative development builds towards wellbeing, understanding, for example, how beauty, such as the beauty of water and trees revealed through walkable blue and green infrastructure—can contribute to healing, especially when coupled with local strategies to increase economic security, reduce commutes and increase family time.

1. Disparities in Health Outcomes

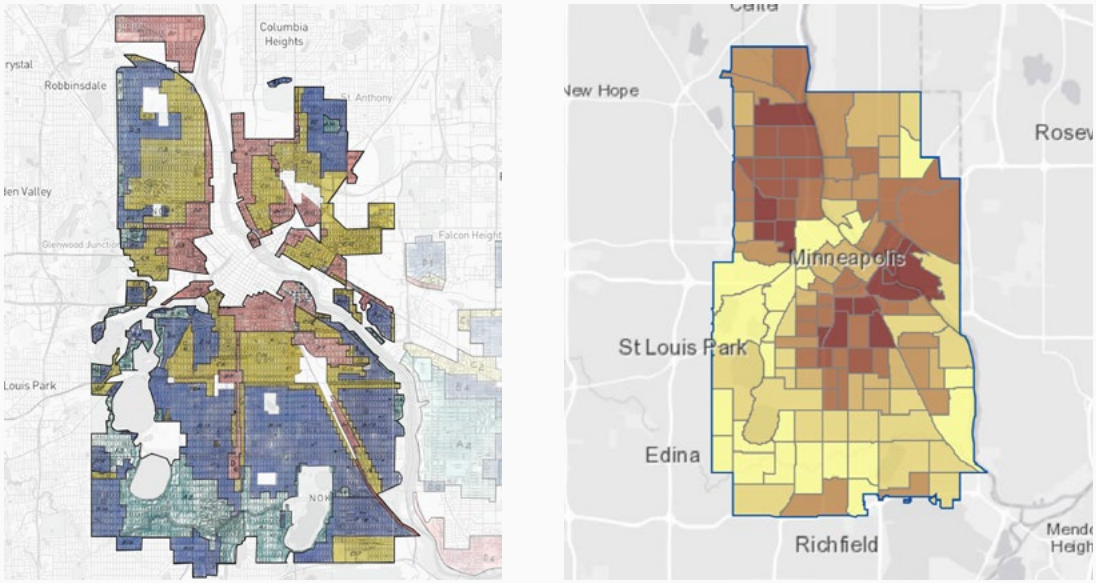
Minneapolis has significant socioeconomic and racial health disparities that are manifested at the neighborhood level. There is perhaps no starker illustration of these disparities than the measure of life expectancy. While Hennepin County has a high average life expectancy of 80 years, that figure varies considerably from zip code to zip code.[49] In Minneapolis, residents in affluent areas can expect to live into their mid-80s, with some census tracts reaching a life expectancy as high as 88 years. However, residents in low-income areas generally have a life expectancy in the low-70s, with some neighborhoods, such as a census tract in Hawthorne McKinley, only reaching 68 years. This means that city-wide there is a life expectancy gap of 20 years between the best and worst-performing tracts.

Life expectancy can vary as much as 20 years between Minneapolis neighborhoods.

These differences in life expectancy are mirrored by the differences in health status amongst neighborhoods. In some neighborhoods in Minneapolis, especially in areas of concentrated poverty, as many as 17% of residents report to be of poor physical health, and 19% report not being in good mental health.

From Land Use to Health & Wellbeing: History's Long Echo

The outline of the redlining map reads like a blueprint for many socio-economic maps of present times, including health outcomes. While the relationship is complex, it shows that structural differences in neighborhoods have not changed in almost a century.



Left: Minneapolis Redlining map, 1930s. (See Land Use Chapter)
Right: Mental Health Prevalence, 2017. Respondents aged ≥18 years who report 14 or more days during the past 30 days during which their mental health was not good. The lightest yellow mean a prevalence of 7-8% amongst respondents, the darkest reds indicate a prevalence of 16-19% amongst respondents. The map for "physical health" is nearly identical.

2. The Role of Social Determinants of Health

Amongst health experts, insurers, and policymakers, there is increased awareness of how social determinants of health—such as access to food, social connectedness, and safe neighborhoods—affect population health. Research has shown that half of all health outcomes are due to economic, social and environmental factors, with behaviors and clinical care accounting for 30% and 20% respectively.[50]

There is increasing evidence that a person's zip code is a stronger predictor of health than their genetics. Since American cities are highly segregated by race, many disparities in health are racial disparities.

Every 7 minutes a Black or African American person dies prematurely in the United States. This amounts to 200 people a day who would not die if they had health outcomes similar to white people.[52]

For example, data that maps the level of physical activity amongst Minneapolis residents mirrors almost exactly the health outcomes map on the previous page. In the deepest red areas, such as Hawthorne-McKinley, as many as 35.5-42% of the population report no leisure-time physical activity among adults. Areas with low physical activity share similar characteristics: they are low-income, experience high levels of crime, and adults are more likely to be unemployed, or conversely, work multiple jobs with unpredictable schedules. Knowing the importance of exercise does not easily translate into action when streets are not safe to run, green space is out of reach, childcare is not accessible, and people experience chronic stress about not being able to make ends meet after an exhausting day of work.

This is one of the many cascading effects when a neighborhood loses equity, where ill-conceived infrastructure and economic distress have a direct and daily impact on individual and community health and wellbeing. Unhealthy outcomes, in turn, further undermine the economic potential of a district, starting a vicious cycle that is hard to escape.

Health insurers, with Blue Cross Blue Shield of Minnesota being a leader among them, have begun to think about the long-term consequences of social determinants of health. Addressing these factors in a targeted and concerted way not only fits with the non-profit mission of Blue Cross, but it also makes financial sense wto take a step back from quarterly results and take a long-term view instead. The insurer made a pioneering move with its "Healthy Together Willmar"[51] initiative, investing multiple millions of dollars in a rural town that was both experiencing increasing poverty, and an influx of immigrants drawn to jobs at the nearby poultry processing plant. Recognizing that health happens in communities, the funds supported citizen-lead initiatives, which included businesses such as grocery stores and senior care services, as well as places and spaces that foster connectivity. Today, downtown Willmar does no longer resemble a dying rural town, but a vibrant place with populated sidewalks and storefronts, where people who were born in the region are forming friendships with new residents coming from Latin America and Northeast Africa. With access to social connectivity, healthy food, and good local jobs, all Willmar residents now have a much better chance of leading healthy and fulfilling lives.

Zooming out even further to include all infrastructure, such as water, energy, food and materials management, restorative development provides a model for building healthy neighborhoods—physically, socially and economically. When metrics take into account the cost of disease, investments in structural change that would otherwise be unfeasible become possible, kickstarting a virtuous cycle that can pay dividends many times over.

3. Health of Business and Industries: The Long View

When we consider health and wellbeing in restorative development, we don't focus only on people and communities. The health of businesses and industries is equally important as a foundation for net-positive outcomes.

While many businesses and large corporations in the Minneapolis-St. Paul metropolitan area have been doing well in the pre-COVID-19 economy, local governments cannot rely on them to sustain the region indefinitely. Just like ecosystems, corporations have a life cycle, and it is shortening dramatically. A study by McKinsey found that the average lifespan of companies listed in Standard & Poor's 500 was 61 years in 1958. Today, it is less than 18 years. If McKinsey's projections are correct, 75% of the companies currently quoted on the S&P 500 will have disappeared as soon as 2027[53].

The shortening lifespan of companies is partially due to accelerating technological disruptions and other structural factors. It has implications about the future of work, requiring more flexibility in the labor markets and more mobility for workers. (This is coupled with the rise of the gig workers—people who earn income outside of traditional, long-term employer-employee relationships—which the Bureau of Labor Statistics reported in 2017 to be 34 percent of the U.S. workforce.[54)] Cities are likely to experience this shift as a decrease of long-term financial security of their residents, as well as increased vulnerability to downturns. These externalities originate in the private sector but are borne by municipalities, and are generally not measured and accounted for anywhere in the system. In this case, these externalities are adding to growing socio-economic problems that governments continuously need to invest in.

3.1 Barriers to Sustainability

Technology is not the only reason why companies will die, or at least, will be forced to reinvent themselves. Given the finite horizon of our resources and accelerating environmental crises, it is simply not conceivable that companies will be able to continue to operate and do business as usual over the next decades and century.

Many companies have set sustainability goals and are actively reducing their footprint. But they are doing so in a broken system, where incremental improvements will not be enough to avoid crossing the tipping point towards irreversible damage. Sustainability is not an attainable end state when externalities are not measured and accounted for at a system-wide level. As a consequence, well-intentioned people in well-intentioned companies are finding themselves with a circle they cannot square, wanting to prove sustainability while having to grow profits at the same time.

A few companies, such as Patagonia are attempting a radical shift towards a business model of circularity. They mean it when they tell shoppers "Don't buy this jacket" and refuse to open their stores on Black Friday. They don't shy away from posting less than flattering pictures of foreign manufacturing factories in the spirit of radical transparency next to every item they sell online. Given their rising popularity, this seems like a winning business strategy.

However, Patagonia's circular efforts are hindered by a lack of proper public and shared circular infrastructure. Their quest is one of a single circular company attempting to be successful in a linear system, forcing them to absorb higher costs per unit. What's more, they are attempting to prove a

business case in a world where their competitors continue to lobby and succeed in obtaining permissions to pollute.

Corporations, like any self-interested actor, are looking for the path of least resistance within the system that they operate in. While sustainability has become a strategic pillar for many companies, they seldom reengineer their structures, processes, and operations to truly achieve a net-zero impact. Instead, improvements happen in silos, such as optimizing supply chains or building operations. While some achieve impressive results, they risk only becoming greener on the margins, even as production, profits, and pollution grow. Sometimes the attempt to adopt sustainability in their business practices has not only proven to be unsuccessful but also misleading, resulting in accusations of greenwashing that diminish a company's 'social license to operate'.

3.2 Lack of Circular Infrastructure

In general, companies have few, if any, incentives to question the system that they and the rest of the world operate in. Even if they recognize the finite nature of the linear take-make-waste model of production and consumption, they may not know how to step out of it, and that there is a place for their voice in shaping 21st-century infrastructure.

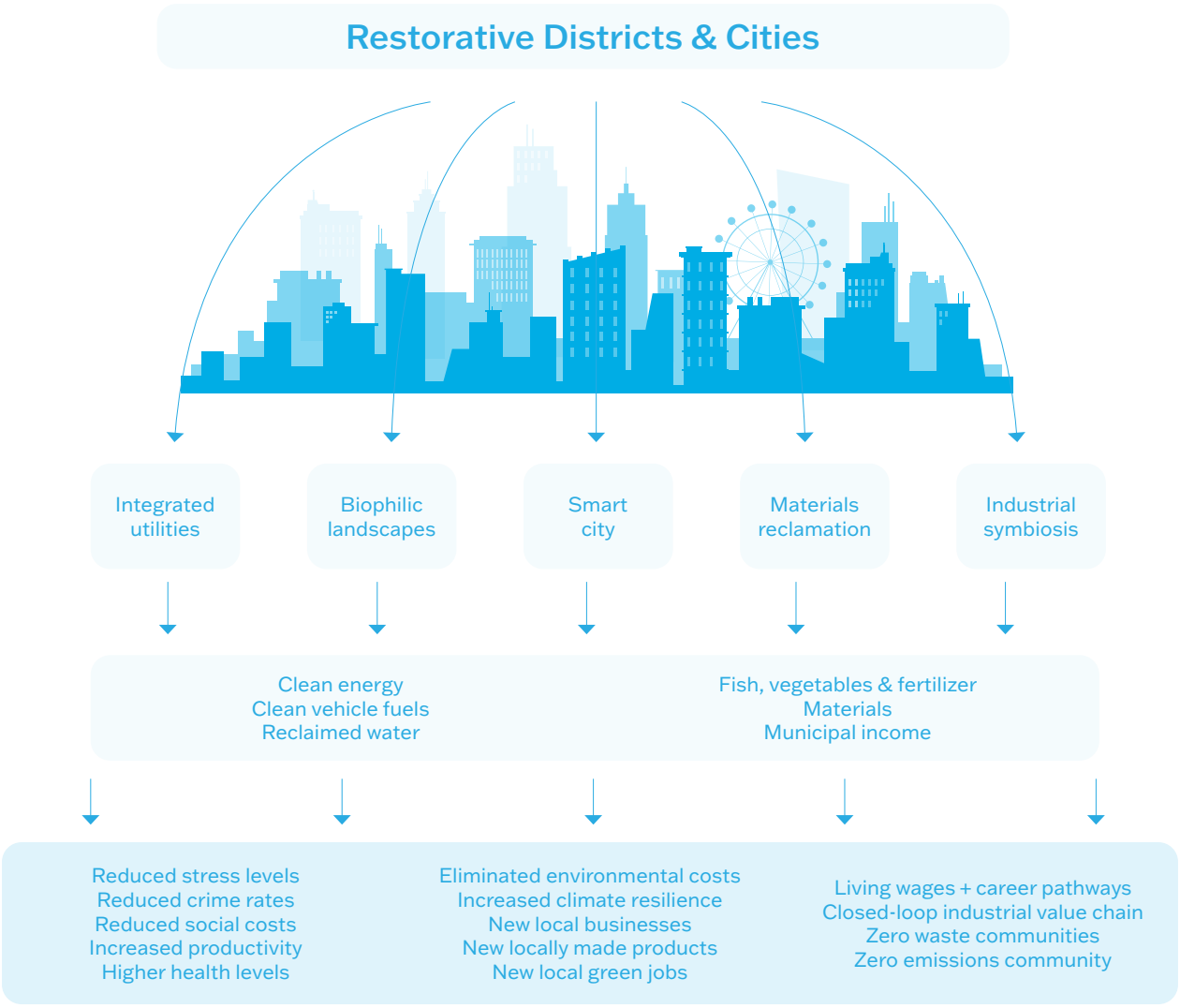
Traditionally, industries have not participated in infrastructure development, leading to suboptimal outcomes.

For example, the rise of the plastics industry was met by the public sector with increased recycling infrastructure, where recyclables are quickly and efficiently moved out of the sight of households and businesses. However, most plastics are contaminated and not recycled, and when they are, they usually end up as vastly inferior materials. This system, which is working well only on the surface, has allowed for the proliferation of plastics rather than incentivize and enforce the early development of alternatives. Sparked by the environmental crisis, recent innovation such as packaging made from bioplastics are preferable alternatives in many ways, but cannot be managed by the current infrastructure, and are instead creating harmful methane and other gases in landfills.

Companies are making incremental improvements in a broken system, putting true sustainability out of reach

With stricter regulation, coupled with public sector commitments to support the private sector's material innovation through new infrastructure, the plastics crisis could have been averted decades ago.

In the absence of such strong collaboration, the government has no choice but to permit certain levels of pollution to secure economic growth, and even well-intentioned companies cannot innovate due to the lack of shared infrastructure. The gulf between the public and private sector is further exacerbated by their siloed natures, and the differences in language they each use.



3.3 Economic and Equitable Growth for the 21st Century

In recent years, some large international corporations have taken a deeper interest in circularity. While not moving as fast as smaller companies, such as Patagonia, their knowledge has matured to a point where they too are looking for shared public infrastructure that can enable circular materials management. Rather than virgin resources, they are looking for reliable, high-quality used materials that they can remanufacture into new products. Just like mining for virgin resources provided the economic lifeblood for rural towns in the 20th century, so does "mining" for used resources present an opportunity for cities and metropolitan areas in the 21st century.

It presents an opportunity to build a new local economy and industry in a way that creates equitable growth and wealth for businesses and communities alike. While the circular economy is defined by closed-loop material management, restorative development scales this approach to other resources, creating a closed-loop infrastructure for water and energy, and creating further opportunities for industrial symbiosis that small and large companies can tap into. Coupled with career pathways and living-wage job opportunities, integrated green and blue space, affordable housing, and safe and accessible neighborhoods, these restorative developments can become attractive 21st-century places to live, work, and play.

SPOTLIGHT ON ECO-INNOVATION: AN OPPORTUNITY FOR SMALL AND LARGE BUSINESSES

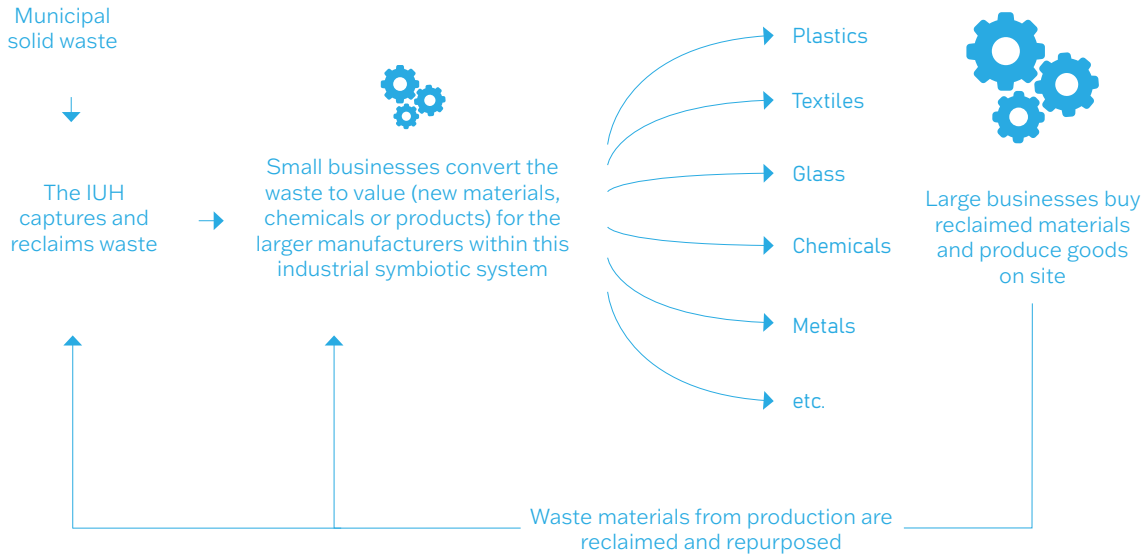
The IUH's material reclamation and re-purposing system creates multiple circular loops that can serve small and large businesses while creating new jobs on site.

Pulling from the municipal solid waste stream, IUH equipment and technologies separate and treat materials, which can then be processed and converted to value by specialized small businesses, including local startups.

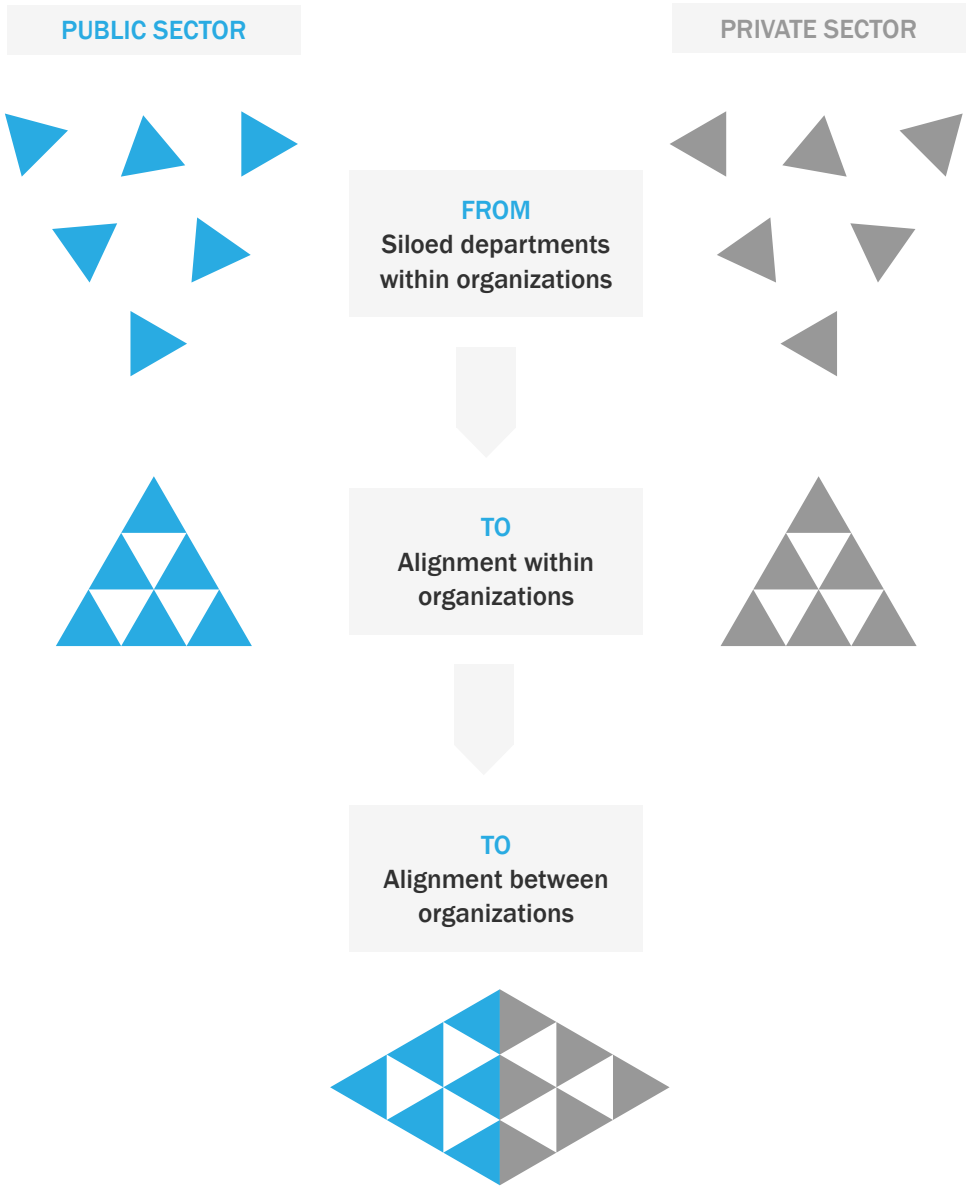
Small businesses serve an important role as they turn materials from the IUH into value and then supply it to larger manufacturers looking for access to reclaimed materials. Large manufacturers may set up local production facilities on site, creating additional jobs. Waste created by these on-site manufacturing processes can then be captured within the system and continue to be processed in ways where waste from one system is an input for another.

This shared materials reclamation infrastructure allows companies to reach resource-positive goals that will allow them to compete in the 21st century economy. In addition, it provides and opportunity to create a thriving local economy with new green jobs growth, while also eliminating landfills and cutting costs related to waste management and associated environmental and social costs.

INTEGRATED MATERIAL RECLAMATION, TREATMENT AND REMANUFACTURING PROGRAM



Public-Private Alignment for Circular and Restorative Infrastructure



3.4 Public-Private Alignment for Circular and Restorative Infrastructure

Creating this economic opportunity requires local governments to take the first step in building the foundational blocks of circular and restorative infrastructure. However, just like companies, governments tend to operate in silos. While their work may be tied to common goals and objectives, departments are not integrated sufficiently with one another to truly plan and implement change at the systems level.

Therefore, restorative development requires departments within local governments to align on the need and benefits of an integrated infrastructure. Likewise, more companies need to fully understand and seize the circular opportunity and align their own departments for systems change. Next, alignment is needed between government and businesses on the role of each partner, on their commitments, and their tolerance of risk. Lastly, they need to align on what kind of materials management infrastructure and other closed-loop infrastructure best serves the region and the circular business ecosystem.

2.4.2 CULTURE & IDENTITY

Minneapolis is home to a vibrant and diverse population with over 130 nationalities and indigenous cultures. Increased national recognition of the cultural identity of indigenous peoples has become an increasing part of Minneapolis's identity, with indigenous art and places names increasingly becoming part of the cityscape.

Sports are within the city's cultural DNA and are well supported in Minneapolis. The Vikings, Timberwolves, and the Twins stadiums are all within the immediate downtown area and access to Gopher games, the MN Wild hockey, and MN United soccer matches are all within 30 minute trip on the light rail. Similarly, the city has countless theaters, music venues, art, and cultural centers, restaurants, and cafés, representing a vast array of genres and cultures that make up a large portion of the city's identity. An unmatched amount of parks and green spaces, and the more recent commitment to building out bicycle infrastructure, which is now the nation's largest, also contributed heavily to Minneapolis being recognized as one of the nation's most livable cities.

Minneapolis is an economic hub and home to countless organizations that together form a healthy and diverse economic base. But it is also home to countless non-profit organizations that represent the gap between government performance and community needs. In the wake of the death of George Floyd and the subsequent protests, Minneapolis experienced a collective reckoning, as its polished identity turned into a worldwide symbol for racial inequity. City leaders have made closing the equity gap their top priority, even as established processes perpetuate ingrained patterns. The city must grapple with the reality of continuing to build against community demands, as evidenced for example in the approval of a new music venue proposition at the Upper Harbor Terminal district in North Minneapolis.

Typical for U.S. cities that have grown fast in the last century, Minneapolis is a car-centric city marked by a lack of proximity between key institutions, services, and work. Beyond infrastructure, land use, and economic development practices played a key role in forming the city's current identity. The built environment reflects the economic growth cycles of the past 100 years. While these cycles created prosperity for many, they left marks on the built environment that feel outdated today. For example, historic sites, landmarks, beautiful architecture, and monuments in Downtown had to make way for bland office buildings and surface parking in the 1960s. In more recent decades, many neighborhoods attracted lucrative redevelopment agendas that often led to gentrification and dislocation of communities and people. This comes on top of the equity flight that followed the widespread suburbanization and highway development that cut through the city, which left a long-lasting mark on many communities, where it depleted social and economic capital and cultural authenticity.

Aiming to become a livable city for all will require leaders to rethink existing growth models to foster a more inclusive economy for the 21st century.. Restorative Development offers a pathway to more locally resilient economic development that has the potential of not only tapping into unused local resources but also attracting industries by providing an infrastructure for eco-innovation and circularity. In doing so, it can respond to community needs for equity and a better quality of life.

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3. Appendix

3.1 Minneapolis Goals and Gaps Analysis

The following conceptual framework is intended to help us understand existing goals, measurable targets, and policies as set forth in the City of Minneapolis 2040 Comprehensive Plan, and supporting documents such as the Minneapolis Climate Action Plan, Zero Waste Plan, Food Action Plan. Also mapped are publicly published targets by Restorative Development Partners Hennepin County, MWMO, Centerpoint Energy.

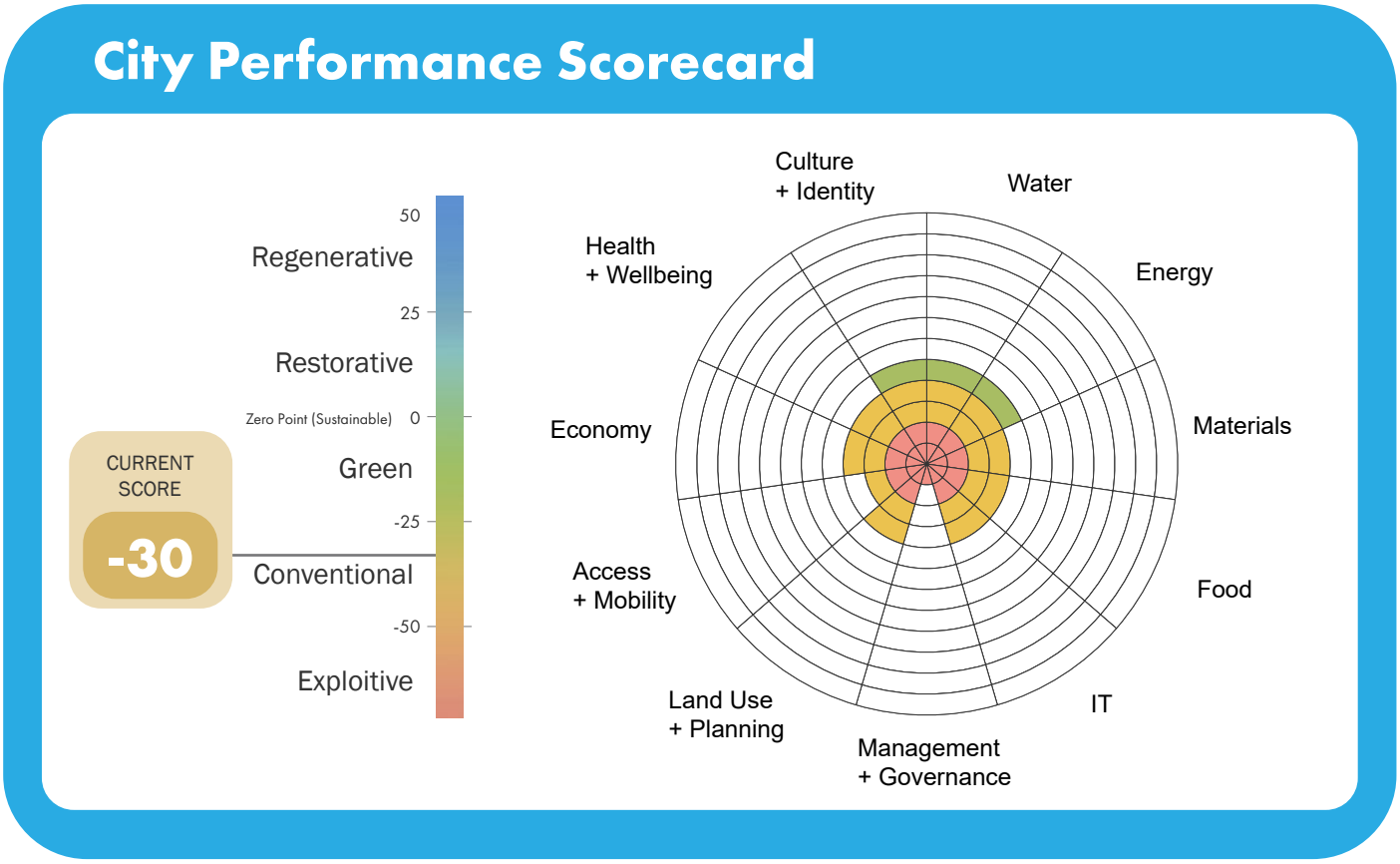
When vetted by all partners, this document will serve as a tool to identify gaps and opportunities that will require additional focus in order to plan for and implement restorative development.

Restorative Development KPI	
Minneapolis 2040 Goals	The following framework maps the goals of the Minneapolis 2040 comprehensive plan against the 11 key performance areas (KPIs) that guide restorative development.
Measurable Targets	It also maps measurable targets that the city as well as other restorative development partners set for their organizations.
Policies	Lastly, we coded all policies from the 2040 plan and mapped each of them to one or more areas. The framework shows the numerical allocation of these policies in each bucket (KPI) to give a sense of their distribution.

	Water	Energy	Materials	Food	IT & Smart City	Management & Governance	Land Use & Planning	Mobility & Access	Economy	Health & Wellbeing	Culture & Identity
MPLS 2040 Goals	**Clean Environment** In 2040, Minneapolis will have healthy air, clean water, and a vibrant ecosystem.					**Proactive, Accessible, and Sustainable Government** in 2040, Minneapolis City government will be proactive, accessible, and fiscally sustainable.	**High-Quality Physical Environment** In 2040, Minneapolis will enjoy a high-quality and distinctive physical environment in all parts of the city.	**Eliminate Disparities** In 2040, Minneapolis will see all communities fully thrive regardless of race, ethnicity, gender, country of origin, religion, or zip code having eliminated deep-rooted disparities in wealth, opportunity, housing, safety, and health.			
	Climate Change Resilience In 2040, Minneapolis will be resilient to the effects of climate change and diminishing natural resources, and will be on track to achieve an 80% reduction in greenhouse gas emissions by 2050.		**80% Recycle + Compost** Recycle and compost 50% of its citywide waste by 2020 and 80% by 2030. [MPLS Zero Waste Plan]	**Urban Agriculture** Increase (by 50% in 5 years) the overall amount of sustainably produced "local" urban agriculture [Minneapolis Food Action Plan]		**Equitable Civic Participation System** We will have an equitable civic participation system that enfranchises everyone, recognizes the core + vital service neighborhood organizations provide to the City and builds people's long term capacity to organize to improve their lives and neighborhoods.	**Complete Neighhborhoods** In 2040, all Minneapolis residents will have access to employment, retail services, healthy food, parks, and other daily needs via walking, biking, and public transit.	**More Residents and Jobs** In 2040, Minneapolis will have more residents and jobs, and all people will equitably benefit from that growth.	**Creative, Culture and Natural Amenities** In 2040, Minneapolis will have the creative, cultural, and natural amenities that make the city a great place to live.	
	Fishable + Swimmable Water Restore surface and stormwater to a condition that is swimmable, fishable and safe for all of its other designated uses. [MWMO]	**100% Renewable Electricity** Get 100% of community-wide electricity use from renewable sources by 2030. [MPLS City Resolution]		**Food Access** Decrease (by 50% in 5 years) the population without access to urban agriculture [Minneapolis Food Action Plan]					**Healthy, Sustainable and Diverse Economy** In 2040, Minneapolis will remain the economic center of the region with a healthy, sustainable, and diverse economy.		**History & Culture** In 2040, the physical attributes of Minneapolis will reflect the city's history and cultures.
		100% Carbon Free Electricity Get 100% of electricity from carbon-free sources by 2050 [State of MN, XCEL]							**Living-Wage Jobs** In 2040, all Minneapolis residents will have the training and skills necessary to participate in the economy and will have access to a living-wage job.		
									Affordable and Accessible Housing In 2040, all Minneapolis residents will be able to afford and access quality housing throughout the city.		
									Healthy, Safe & Connected People In 2040, the people of Minneapolis will be socially connected, healthy, and safe.		
Measurable Targets	**-80% CO^2 Emissions** Reduce carbon emissions 80% by 2030 (2005 baseline). [XCEL]	**-80% CO^2 Emissions** Reduce CO^2 emissions by 30% by 2025 and by 80% by 2050 (2006 baseline). [Minneapolis Climate Action Plan]	**-20 to 30% CO^2 Emissions** Reduce emissions attributable to natural gas usage in heating, appliances and equipment within the residential and commercial sectors by 20 to 30% by 2040 (2005 baseline). [CENTERPOINT]				**10-Minute Access to Transit** By 2030, 90% of residents will be able to access frequent transit within a 10-minute walk. 3 out of 5 trips will be taken by foot, bike or transit. (MPLS Transportation Action Plan)				
		+10% Local Renewables Increase electricity from local and directly purchased renewables to 10% 2025 [MPLS City Resolution]					**10-Minute Access to Parks** All Minneapolis residents live within a 10-minute walk of a park. [MPRB]				
# of Policies	Water	Energy	Materials	Food	IT & Smart City	Management & Governance	Land Use & Planning	Mobility & Access	Economy	Health & Wellbeing	Culture & Identity

3.2 RESTORATIVE PERFORMANCE SCORECARD (DETAILED)

Assessing the starting point towards becoming a restorative city



The following section reflects key findings from the baseline assessment which measures and evaluates performance across 2000 performance areas and reports in numeric scores and non-financial terms. In these numeric scores the zero point is a place of neutrality – where equity is neither lost nor generated. As in all conventional cities, the scores expose more net-negative performances than net-positives. It is important to understand that these negative scores are not stating that 'all is bad'. Rather, it exposes the fact that many good things that are being done are tainted by net-negative performances within the system that often make outcomes 'less positive' or 'net-negative'.

11 KEY PERFORMANCE INDICATORS	Total Scores	Current Status
WATER	-20.7	Green
ENERGY	-23.4	Green
MATERIALS	-35.0	Conventional
FOOD	-35.2	Conventional
IT	-27.0	Conventional
ACCESS + MOBILITY	-38.1	Conventional
LAND USE	-30.9	Conventional
MANAGEMENT + GOVERNANCE	Not rated	
ECONOMY	-31.0	Conventional
HEALTH + WELLBEING	-27.5	Conventional
CULTURE + IDENTITY	-25.6	Conventional

With a legacy of a one-of-a-kind park system and a number of F500 companies amongst many amenities, the City of Minneapolis has long been included in rankings of the most livable and healthiest cities in the United States.

However, having followed typical industrial and post-industrial development patterns, the urban system creates many negative economic, social, and environmental externalities that lead to overall negative scores, even as incremental improvements are underway. For example, having developed as a car-centric city, walkability and bikability is limited and difficult to improve.

Resources, such as water, energy, and materials are managed well within their linear silos, where they are optimized for one-time use before being discarded quickly and efficiently. Closed-loop, circular principles are not yet applied to harness synergies that would yield restorative benefits. Instead, improvements are made within their own silos, and there is often a disconnect between the city's stated goals and desired outcomes on the one hand and procurement practices on the other.

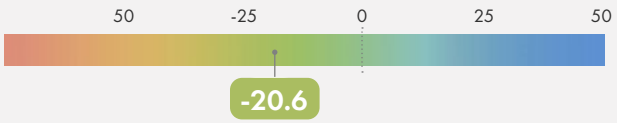
Leaders at the City of Minneapolis are reckoning with the fact that the city is not livable for everyone. Confronted with its history of institutionalized racism, which has led to some of the biggest racial disparities in the nation, leaders are taking a deeper look at the impact of traditional land-use, infrastructure, and economic development practices on community wellbeing.

The following summary briefs are intended for use in Phase 2 of the project, where each of the 11 KPIs will be matched with a team for the next phase of work.

When read together, readers will notice repetitions and overlaps between the 11 summaries.

However, they are designed as individual tools that offer each of the 11 teams a holistic and complete picture of their KPI, helping create a mind shift towards systems thinking and away from siloed approaches.

1. WATER



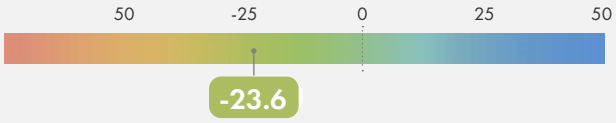
Water supply, wastewater, and stormwater are treated in separate systems and in a linear fashion, where water is discarded quickly and efficiently after use. Water is sourced from the Mississippi and is readily available and plentiful throughout the city at low rates, although the cost may present a burden to low-income households. The water supply is treated to the highest historical standards, but filters are still used by many households to ensure no long-term effects of residual elements left in the water supply. Wastewater is treated to government standards (but not to 100% purity) and discarded after a single use into the Mississippi. Stormwater is discharged into the river and lakes untreated, where algae and bacteria threaten water and environmental health as well as the socio-economic health of surrounding communities. Since wastewater and stormwater are treated as a liability, they are generally not used for local value creation, although some efforts are made to advance projects that promote reclamation and reuse of storm- or brown water for individual buildings.

Water features such as ponds, streams, and water fountains are generally not used as blue infrastructure to enhance the built environment and neighborhood development. The Mississippi River transports goods but is not utilized for transportation of people, or for recreational activities one would see in other cities with similar access to the expansive riverfront.

Looking towards the next 50-100 years and considering climate change, population growth, and the depleting groundwater resources of the surrounding metropolitan region adding to future water supply pressures, the city's centralized and siloed water infrastructure may prove vulnerable and insufficient to deliver high-quality water at affordable rates to all its citizens and industrial applications.

The water infrastructure still supports a take-make-waste use of this valuable resource. Water is generally not a part of a more comprehensive resource strategy where integration with other resources, such as energy and materials, could take place.

2. ENERGY



Safe and reliable distribution systems provide plentiful, low-cost energy for all sectors of society. However, despite the low cost of energy, with over 31% of Minneapolis households earning less than $34,999, energy may be a cost burden to many households.

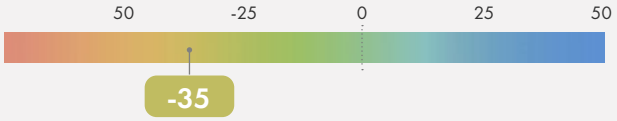
With regard to emissions, the energy mix is shifting away from coal (which is still the largest source) towards a higher percentage of renewables and natural gas for the generation of electricity. Even as these improvements are underway, pollution from heavy use of fossil fuels, especially in transportation and heating of buildings causes high social, environmental, and economic costs, increasing calls for a more stringent regulatory environment and zero emissions goals.

The city is reliant on a regional, centralized grid with only 3.5% of the city's electricity generated within city limits, even as the city is attempting to increase this share to 10%. This makes the city extremely vulnerable to catastrophic events and prolonged power outages. Local energy storage is limited and consists almost entirely of natural gas. There is virtually no electricity storage capacity.

Regarding innovative practices and technologies, the city's goals are focused on energy savings in buildings and increased usage of renewables, such as solar and wind. However, comprehensive smart city strategies are not yet being planned and implemented. The energy grid and governance structure continue to manage energy as a single-use resource that is burnt and lost at use, with little to no recycling or recovery. There has been limited investment in carbon capture and sequestration, both within the energy system and habitat. Currently, sequestered carbon is not yet created and used in Minneapolis, representing an untapped opportunity for eco-innovation in the city.

Goals to reach 100 percent renewable electricity citywide are not yet aligned with the goals of local utilities who set their own goals as they are preparing to adapt to an increasingly stringent regulatory environment as well as the recently introduced social cost of carbon in Minneapolis. Goals on renewable electricity and reduction of emissions – which implies the need for increased electrification of the grid, represents another challenge: can the city claim success on zero-emissions goals if emissions and other externalities that come with providing energy to Minneapolis continue to be incurred elsewhere? Waste and true-cost accounting for solar panels and windmills are limited or nonexistent, which makes an accurate comparison between types of energy difficult. Zero-emission goals, when seen in the context of all energy—transportation and heating included—also require swift action on replacing fossil fuels in those sectors. Utility companies recognize the potential that comes with hydrogen, which presents a massive opportunity for the city and region.

3. MATERIALS

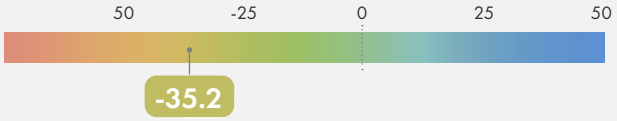


Waste and materials are managed within a linear take-make-waste economic model and infrastructure. There is an abundance of private haulers who are effectively in control of this valuable resource. While waste services are highly effective at making waste disappear quickly and cheaply, only a few materials are truly recycled at equal value, with the rest ending up in landfills, incinerators, or lower-value products. Success is measured in silos, with many missed opportunities, such as creating synergies and closed material loops which would be attractive to businesses and could generate a large number of new green jobs and strengthen the local economy in the city.

The high number of private haulers adds to truck traffic and noise pollution in neighborhoods. Tipping fees are generally low which has made landfills a financially attractive option for disposing of waste. The low tipping fees are a barrier to innovation in the city and region and present obstacles to positioning the waste chain as an opportunity for circular economic material and resource management that benefits the local economy.

Material management strategies to create entire ecosystems for materials innovation, reuse, and remanufacturing do not yet exist in Minneapolis or the region.

4. FOOD



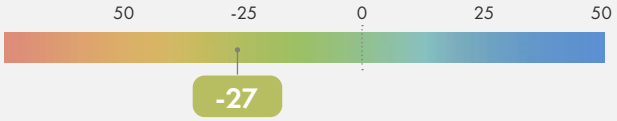
Food is part of a heavily specialized and centralized national system which achieves high efficiencies within silos, but causes significant externalities and misallocation of resources

at the system level. In Minnesota, almost all food consumed locally comes from out of state, consistent with the U.S. average, where food travels an average of 1,500 miles before it reaches the plate. Consequently, the locally available food supply has low resilience to catastrophic events, such as widespread long power outages or prolonged pandemics that threaten both short-term availability and supply chains. The food transportation infrastructure, while generally reliable, leads to high truck traffic that adds to noise and air pollution, as well as wear and tear of roads and highways.

While “junk” food is cheap, healthy food (as recommended by the FDA’s dietary guidelines) is not affordable for the third of Minneapolis residents who earn below living wages. In Hennepin County, more than a tenth of the population, including children, are food insecure.

In Minneapolis, about 30 farmers’ markets provide healthy food options (mostly at retail rates) throughout the city, but there are 11 food deserts, which disproportionally affect people of color. Urban agriculture is in its infancy but not established at a larger scale or through a coordinated resource strategy plan. Local urban agriculture projects in Minneapolis do not support wages and are volunteer-driven and dependent on continuous grants for their existence.

5. INFORMATION TECHNOLOGY

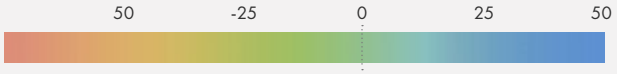


Minneapolis has a good and reliable internet infrastructure and mobile networks with high-speed options, which were first developed in more affluent neighborhoods and business/finance districts downtown before expanding to the rest of the city. The city also offers an outdoor internet network for residents and visitors that covers almost the entire city.

The cost of high-speed internet can be prohibitive for low-income communities, which impedes their access to this vital 21st-century resource. This disparity has been exposed during the COVID-19 crisis where low-income communities had a difficult time connecting to online classes. In response, the city worked with private internet providers to offer low-cost internet options to residents.

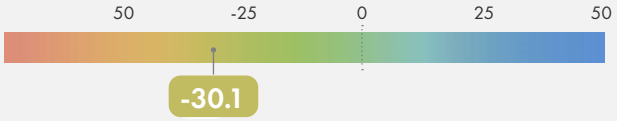
A "smart city" strategy to monitor and optimize all resource flows, including water, energy, materials, and food, as well as smart transportation infrastructure, including drone infrastructure, has not yet been conceived or implemented. The increase in commercialization of artificial intelligence (AI) and automation and its impacts on employment and wealth distribution poses a threat that Minneapolis, like many cities, is not yet prepared for.

6. MANAGEMENT & GOVERNANCE



Due to the complexity of the regional governance structure, management and governance were considered out of scope for this phase of the project.

7. LAND USE & PLANNING



Like in many US cities, past land use and economic development practices in Minneapolis have resulted in a city that is highly car-centric, economically fragmented, and largely disconnected. These same practices have led to a severe lack of proximity between key institutions that can create self-contained thriving communities, including schools, senior care facilities, health and religious institutions, sports and recreation, playgrounds, grocery stores, and job sites. Existing and planned mixed-use developments tend to serve young professionals and retirees, but function as non-local destination stops for others, such as families, ensuring continued car dependence for basic needs.

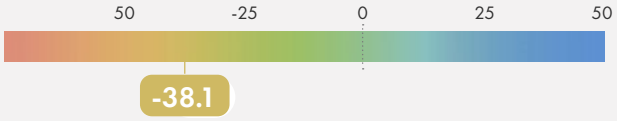
As part of the city's recently approved Comprehensive Plan that lays out goals and vision for what Minneapolis will look and feel like by the year 2040, the city has enabled zoning that allows for light industrial activities within neighborhoods, which is one important element for industrial symbiotic systems and economic development that proposes a significant socio-economic opportunity for the city.

Above-surface electricity lines and parking spots result in a more vulnerable electricity grid, more impervious surface, and visual pollution. The city no longer requires parking spots for new developments which would mitigate some of these issues and add to local functionality as the city develops.

The city is rich in parks and green spaces. However, blue infrastructure (water) is largely underdeveloped within communities where past land-use practices generally favored development over streams and nature. Although almost all residents have 10-minute access to a park, access to larger parks, lakes, and outdoor recreation is limited due to unsafe and car-centric surrounding infrastructure. Parks are often a geographical destination point and are generally not integrated into communities through safe, car-less walk and bike access, leading to underutilization. Urban agriculture is mainly implemented by non-profit organizations and not yet integrated into public spaces on an economically feasible scale or as a part of a larger comprehensive strategy, although the Minneapolis Park Board is exploring options to integrate some urban agriculture into its parks.

Parks, plazas, and other attractions such as water features, statues, and public art have not been a part of the typical neighborhood design in Minneapolis or the region. As these practices are gaining momentum, more physically attractive neighborhoods to live and work will emerge. However, the approach remains conventional, with more advanced beautification, such as biophilic design, not yet systematically planned for or measured as a part of city development.

8. MOBILITY & ACCESS



The transportation system in Minneapolis is highly effective, transporting millions of passengers every day on roads and light rail. Thanks to an increasing amount of bicycle paths, more and more trips are taken by bike each year. At the same time, decades of car-centric transportation infrastructure development has resulted in roads and highways cutting through every neighborhood, making them harder to access and unsafe for non-vehicle traffic in areas that already suffer from poorly marked crosswalks and lack of tunnels and bridges to offer safe passage under busy streets. These negative effects are further exacerbated by noise and emissions.

More recently, the city has taken multiple successful steps to improve safety on its roads through ambitious investments in bicycle infrastructure and safety, resulting in reduced vehicle traffic and pollution, as well as increased health by its residents. A major challenge to success in this area is represented by the sheer amount of roads and intersections in the city that pose access risk, and hamper financial feasibility for alternative travel modes. Furthermore, the population is growing fast, and will largely depend on a car for most of its needs given current infrastructure constraints.

In Minnesota and the City of Minneapolis do not yet offer incentives for zero-emission vehicles (ZEVs). The cost of public transportation remains a challenge for some low-income earners, making access to work and services a challenge.

While heavily used for the transportation of materials, the Mississippi River is not routinely utilized to transport people for short commutes or leisure.

The MSP International Airport is conveniently located minutes from Minneapolis, making it a highly accessible city in a national and global context and a convenient destination for business travelers. Drone traffic systems and smart transportation concepts have not yet been considered for implementation.

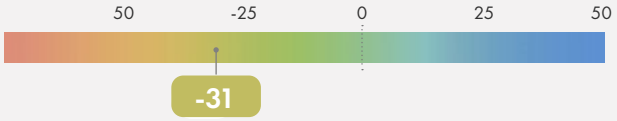
Access

In restorative development, the definition of access goes beyond transportation to include access to opportunity. Since the 1970s, in line with national trends, Minneapolis has seen decreased access to key equity-building opportunities such as income growth, education, homeownership, and affordable health care. Economic growth since the 1970s has been characterized by rising income inequality, where top earners have seen their incomes multiply, while middle and lower incomes grew at a much smaller pace, or remained stagnant. The rising cost of living is an ever-increasing challenge for almost a third of the city's households, disproportionally impacting non-white communities.

This historically undetected and unaccounted for loss in equity also represents equivalent social costs for the city and other levels of local government in the form of housing, food aid, health care, and daycare subsidies, as well as the cost of incarceration, rehabilitation programs, unemployment, therapy and training programs, and other costs that are associated with economic exclusion.

Having inherited a broken system that was decades in the making, a new generation of leaders in city departments such as Community Planning and Economic Development (CPED) are now tasked with finding a way to communities of people that were ignored for decades back into the economy. The city's newly adopted Comprehensive Plan to be realized by 2040 sets bold goals and vision for access and equity in the city, but the path towards achieving these goals is yet to be determined.

9. ECONOMY



When looking at economic foundations beyond financial markets and industrial outputs, the city is rich in assets and resources such as water, energy, habitat, materials, industry, and communities.

However, the Minneapolis economy is based on a conventional take-make-waste economic model that undermines the potential of these vital assets to support local economic, environmental, and social wellbeing. Isolated infrastructure systems that carry out linear functions make resource security and resource efficiencies impractical, expensive to maintain, and impossible to scale to meet city goals.

Historic land use and economic development practices resulted in the geographical and economic exclusion of many communities and over a third of Minneapolis households earn income at under living wages. With cost-prohibitive education, health, and homeownership out of reach for many residents, equity loss is inevitable, and this has been the case in Minneapolis for the past 80 years. The outcome from this continued and unmeasured loss of equity results in a large number of economic leakages.

In general, the city has a well-educated workforce that contributes to its flourishing economy, but a significant portion of this workforce depends on low-skilled jobs outside the city. Although the city has implemented a pathway to living wages to restore and maintain economic prosperity within its communities, it remains handicapped because low-skilled jobs are generally not available within the city limits. Surrounding municipalities continue to promote minimum wages as part of their economic development strategy, attracting Minneapolis' low-skilled workforce with the city shouldering the cost of increasing social assistance, while cementing a lower standard of living.

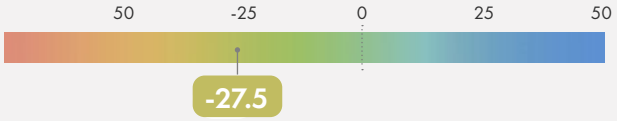
Recently introduced zoning for light industrial activities within the city can help establish and foster a symbiotic ecosystem of industry and smaller, local businesses, which will be more accessible for its workers.

The advent of artificial intelligence, robotics, and automation poses a significant risk to the local economy which the city is currently not prepared for. While businesses are set to gain from this development, the risk of chronic unemployment with related economic costs and social risks is imminent. The economy will accumulate in fewer hands, further increasing the wealth distribution gap and poverty. The elements of this development are all present within the current make-up of the regional economy, where corporations and industries are set up to profit while the city and communities pay for externalities (net-negative impacts) that may result from their operations.

Because the local economy is currently not equity-focused, this conventional economic model is growth-dependent and becomes vulnerable in the absence of growth and ill-equipped to withstand headwinds from outside forces such as the national economy and international trade. Externalities are not accounted for in this conventional economic model. Recently, the city introduced a social cost of carbon aimed to expose the external cost of fossil fuels, an important step towards establishing true-cost accounting in the energy space.

When looking at the competitiveness of Minneapolis in a global context, like most U.S. cities, Minneapolis imposes lower taxes than its European and some other global counterparts. Consequently, the city has less capital to balance budgets while also implementing and maintaining vital infrastructure and social programs. This reality calls for a new and smarter use of natural, social, and economic resources as key building blocks for a more equitable economy.

10. HEALTH & WELLBEING



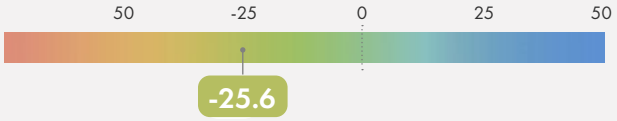
With regard to social health in Minneapolis, income disparities play a significant role in how residents experience health and wellbeing. Even affluent residents with excess income experience stress caused by the lack of proximity to work, health, and services. Long work hours, time spent in traffic, and non-local after-school activities for children, are all triggers to stress in adults, regardless of income level. Residents with low incomes experience disproportionately more triggers to stress, many of which are associated with basic needs and a lack of security in many domains. This includes a lack of financial, education, and career security, lack of housing security, lack of physical safety, and lack of leisure time, as well as food insecurity, risk of ill health, the effects of pollution, and of climate change which includes flooding and the heat island effect.

In terms of economic health, the economy in Minneapolis consists of a variety of industries that are attracted to a stable political environment, reliable infrastructure, and educated workforce. While this economic success has served the city well, the global economic landscape is going through rapid change. Global industries and corporations are increasingly looking for resource- and material-secure locations to conduct their business. Key requirements include opportunities for industrial symbiotic systems and infrastructure. While Minneapolis offers many of the key ingredients and resources, the city is not yet prepared to provide a circular infrastructure to attract circular industries and companies. In fact, the city and region continue to invest in current, outdated, and linear infrastructure, which also works against the city's own goals as laid out in the Comprehensive Plan. The lack of resource integration presents a large and undetected economic, social, and environmental risk, but also an untapped growth opportunity that the city and region can tap into to achieve their goals.

Meanwhile, the financial prosperity that has grown over the last decades has not been all-inclusive. While the private sector is well set up for success, other areas within the local economy have been severely overlooked. Low-wage employers and the rapidly increasing cost of housing, health, and education put equity and wealth building out of reach for a large part of the local population, further disenfranchising entire communities. For example, the accumulated equity loss expressed in missed income opportunities for a neighborhood such Hawthorne McKinley neighborhood is over $91 million, representing one of the biggest opportunities for community and economic restoration in the city.

Minneapolis has areas that offer a high quality of life, especially for those owning single-family homes in leafy neighborhoods. Other neighborhoods, such as North Minneapolis, suffer from blight and industrial pollution. Downtown Minneapolis has become more vibrant over the past decades' thanks to the efforts such as the Downtown Improvement Council. However, noise quality is poor, due to frequent emergency vehicle traffic at all hours of the day. The lack of safely accessible playgrounds for children causes many new parents to move to single-family residential areas and to the suburbs to raise their kids, leading to a "mono-culture" of residents in Minneapolis.

11. CULTURE AND IDENTITY



Minneapolis is home to a vibrant and diverse population with over 130 nationalities and indigenous cultures. Increased national recognition of the cultural identity of indigenous peoples has become an increasing part of Minneapolis's identity, with indigenous art and places names increasingly becoming part of the cityscape.

Sports are within the city's cultural DNA and are well supported in Minneapolis. The Vikings, Timberwolves, and the Twins stadiums are all within the immediate downtown area and access to Gopher games, the MN Wild hockey, and MN United soccer matches are all within 30 minute trip on the light rail. Similarly, the city has countless theaters, music venues, art, and cultural centers, restaurants, and cafés, representing a vast array of genres and cultures that make up a large portion of the city's identity. An unmatched amount of parks and green spaces, and the more recent commitment to building out bicycle infrastructure, which is now the nation's largest, also contributed heavily to Minneapolis being recognized as one of the nation's most livable cities.

Minneapolis is an economic hub and home to countless organizations that together form a healthy and diverse economic base. But it is also home to countless non-profit organizations that represent the gap between government performance and community needs. In the wake of the death of George Floyd and the subsequent protests, Minneapolis experienced a collective reckoning, as its polished identity turned into a worldwide symbol for racial inequity. City leaders have made closing the equity gap their top priority, even as established processes perpetuate ingrained patterns. The city must grapple with the reality of continuing to build against community demands, as evidenced for example in the approval of a new music venue proposition at the Upper Harbor Terminal district in North Minneapolis.

Typical for U.S. cities that have grown fast in the last century, Minneapolis is a car-centric city marked by a lack of proximity between key institutions, services, and work. Beyond infrastructure, land use, and economic development practices played a key role in forming the city's current identity. The built environment reflects the economic growth cycles of the past 100 years. While these cycles created prosperity for many, they left marks on the built environment that feel outdated today. For example, historic sites, landmarks, beautiful architecture, and monuments in Downtown had to make way for bland office buildings and surface parking in the 1960s. In more recent decades, many neighborhoods attracted lucrative redevelopment agendas that often led to gentrification and dislocation of communities and people. This comes on top of the equity flight that followed the widespread suburbanization and highway development that cut through the city, which left a long-lasting mark on many communities, where it depleted social and economic capital and cultural authenticity.

Aiming to become a livable city for all will require leaders to rethink existing growth models to foster a more inclusive economy for the 21st century.. Restorative Development offers a pathway to more locally resilient economic development that has the potential of not only tapping into unused local resources but also attracting industries by providing an infrastructure for eco-innovation and circularity. In doing so, it can respond to community needs for equity and a better quality of life.