Subject: RMI Report on Urban Land Use Reform
Attachments: urban_land_use_reform.pdf

From: Adam Goodman
Sent: Thursday, September 19, 2024 3:41 PM
To: Planning <Planning@a2gov.org>
Subject: RMI Report on Urban Land Use Reform

Hi planning commissioners,

I wanted to draw your attention to this, from the Rocky Mountain Institute: https://rmi.org/insight/urban-land-use-reform/. I've attached a copy of the full report.

The report focuses on Charlotte, Austin, and Denver, but I believe the trends they identify across those three metros also very much apply to Ann Arbor. The key point is: in a "business as usual" scenario with restrictive land use in our urban core, we will continue to see low-density, car-dependent sprawl developments further and further out. On the other hand, if we allow dense infill in the city, that could slow the rate of sprawl, resulting in decreased carbon emissions *both* from reduced VMT and reduced building energy usage.

It's really, really important to note that these findings held true even though the report explicitly excluded consideration of any additional efforts/requirements that would "promote efficient all-electric buildings, integrate solar, and build with low-embodied-carbon materials".

This report and its findings - and especially the regional approach that it took to each case study - also has helped me better understand why we keep seeing apparent conflicts between our A2Zero goals and dense infill development projects. I've reached a rather uncomfortable conclusion: **I believe our A2Zero goal is actually fundamentally misguided.** Rather than merely zeroing-out emissions attributed to areas within the arbitrary lines that define Ann Arbor's city limits, our goal should be to use every tool at our disposal to reduce *regional* emissions as much as possible. I realize, of course, that that is a much murkier and harder-to-measure goal, but I believe it's ultimately the correct one.

Thanks as ever for your careful and thoughtful attention to these issues.

- Adam

Urban Land Use Reform: The Missing Key to Climate Action

Strategies for Lowering Emissions, Increasing Housing Supply, and Conserving Land

Report / April 2023

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About RMI

RMI is an independent nonprofit founded in 1982 that transforms global energy systems through market-driven solutions to align with a 1.5°C future and secure a clean, prosperous, zero-carbon future for all. We work in the world's most critical geographies and engage businesses, policymakers, communities, and NGOs to identify and scale energy system interventions that will cut greenhouse gas emissions at least 50 percent by 2030. RMI has offices in Basalt and Boulder, Colorado; New York City; Oakland, California; Washington, D.C.; and Beijing.

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Executive Summary

For over a century, discriminatory land use and housing policies in the United States have segregated neighborhoods and engineered entire cities around single-family homes and personally owned automobiles. These policies have led to a chronic housing shortage, numerous harms for disadvantaged communities, and sprawling development patterns that exacerbate climate change and ecological harm.

US development patterns — not only encouraged but often mandated by government policies — have led to more and more driving as we live farther away from one another and our daily destinations: workplaces, grocery stores, schools, and green spaces. This has caused transportation to become the single largest carbon-emitting sector in the United States. To meet our global climate goals, we need to reduce transportation emissions by 45% by 2030.[1] This requires both putting 70 million electric vehicles on the road *and* reducing how many miles we drive (also known as vehicle miles traveled or VMT) by 20% per capita over the next seven years.

With this report, RMI seeks to illustrate the potential for land use reforms to achieve significant emissions reductions, focusing on three fast-growing US metropolitan areas: Austin, Texas; Charlotte, North Carolina; and Denver, Colorado (see Exhibit ES1, page 8). Our analysis finds that land use reforms can reduce VMT by up to 13%, building energy use by up to 16%, and local greenhouse gas emissions by up to 14% averaged across these metropolitan regions, relative to business-as-usual (BAU) patterns of development (see Exhibit ES2, page 9). Incremental savings per new resident would be much larger. These findings are consistent with our recent estimate that the United States could avoid 100 million to 200 million tons of carbon dioxide equivalent (CO_2e) annually after a decade if ambitious land use reform strategies were adopted nationwide.[2] This equates to retiring up to 50 midsized coal-fired power plants — or about 20% of the country's remaining coal fleet.[3]

Land use reforms can reduce emissions in the following ways, while producing several other important benefits:

- Shortening distances between housing and people's daily needs, which enables more trips to be made by active and shared transportation modes such as walking, bicycling, public transit, and micro-mobility, thereby reducing VMT. The remaining car trips would also be shorter.
- Reducing building energy use and water consumption by allowing attached and multifamily housing types, as well as integrating them with denser commercial buildings in compact urban forms. Benefiting from shared walls, more efficient use of floor space, and common green space, these building types have lower demand for heating, cooling, and water. They also save materials and construction emissions, both in the buildings themselves and in their associated infrastructure.
- Curbing sprawl and preserving land to serve other needs and functions such as farming, forestry, wilderness conservation, and carbon sequestration, while avoiding the need for housing development in vulnerable areas such as floodplains and wildfire zones.

The reforms modeled in this report are relatively modest. They do not entail wholesale changes to urban form, rebuilding entire neighborhoods, or erecting 20-story buildings. They comprise measures such as upzoning (removing restrictions on multifamily housing), urban infill (building more housing on underutilized land parcels), and transit-oriented development (building taller residential buildings and commercial clusters close to high-quality transit). Coupled with anti-displacement measures that protect renters as well as affordable housing subsidies for the most vulnerable residents, these reforms can help cities become more equitable and affordable.[4] The impact of these reforms would be even greater if they were implemented alongside improved transit, pedestrian, and cycling infrastructure; the development of local retail; and more rational road-usage and vehicle pricing.[5]

Changing our outdated, car-centric, and exclusionary urban land use policies will bring far-reaching economic, social, and environmental benefits. It represents a missing and often overlooked key to addressing the intersecting housing, cost-of-living, and environmental crises. We cannot afford to wait.

Exhibit ES1 Business-as-Usual and Land Use Reform Growth Scenarios in Three Metropolitan Regions

For all three regions, RMI conducted a business-as-usual analysis that assumed continued outward growth of predominantly single-family residential development. For the alternative analysis, RMI produced a land use reform scenario to measure the impacts of greater development of multifamily and mixed-use development in destination- and transit-rich environments.

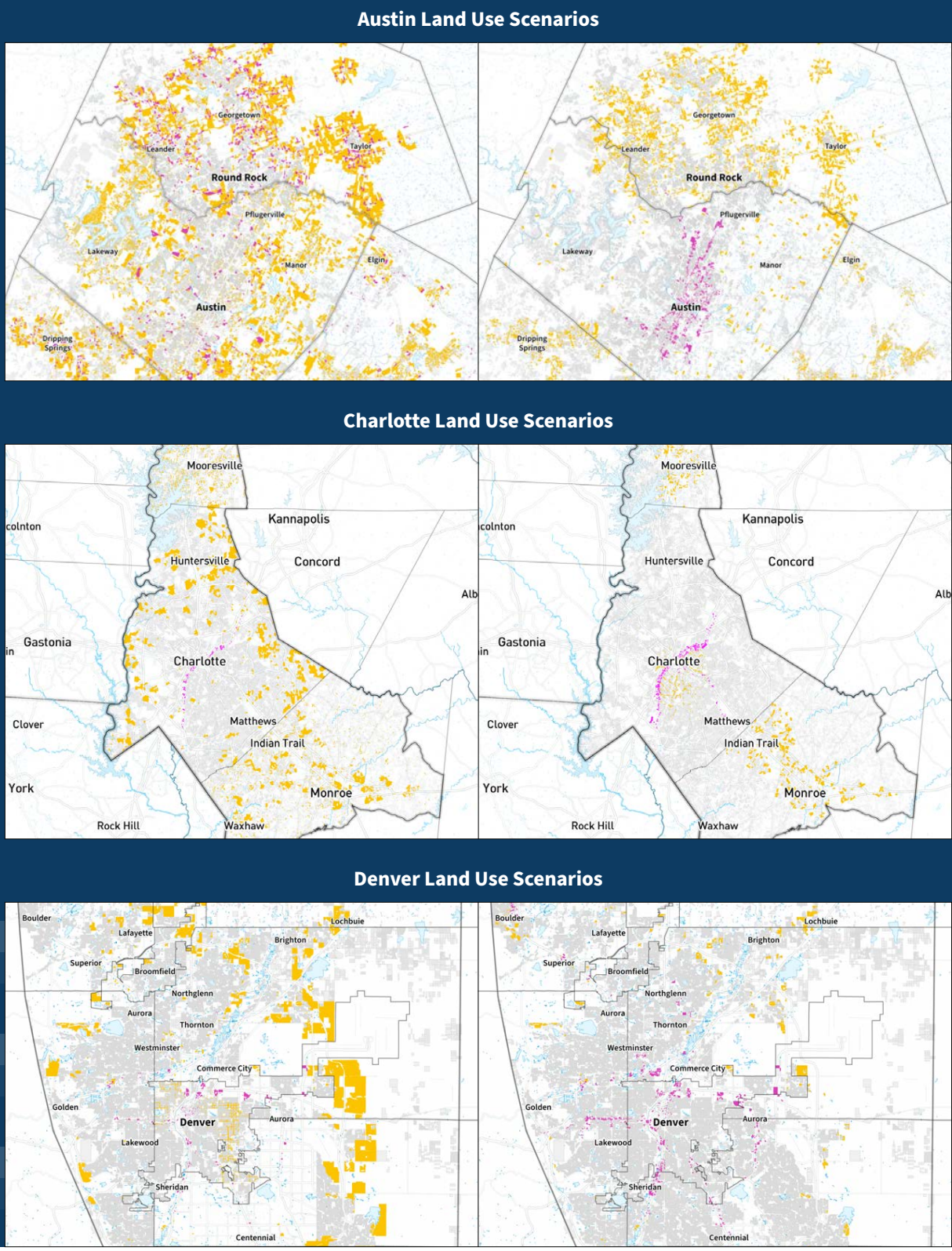
- Single-Family Residential
- Mixed-Use
- Existing Developed Residential

Business-as-Usual vs. Land Use Reform (in parcels)

Austin	BAU	Reform
	58,000	29,843
	2,000	5,278

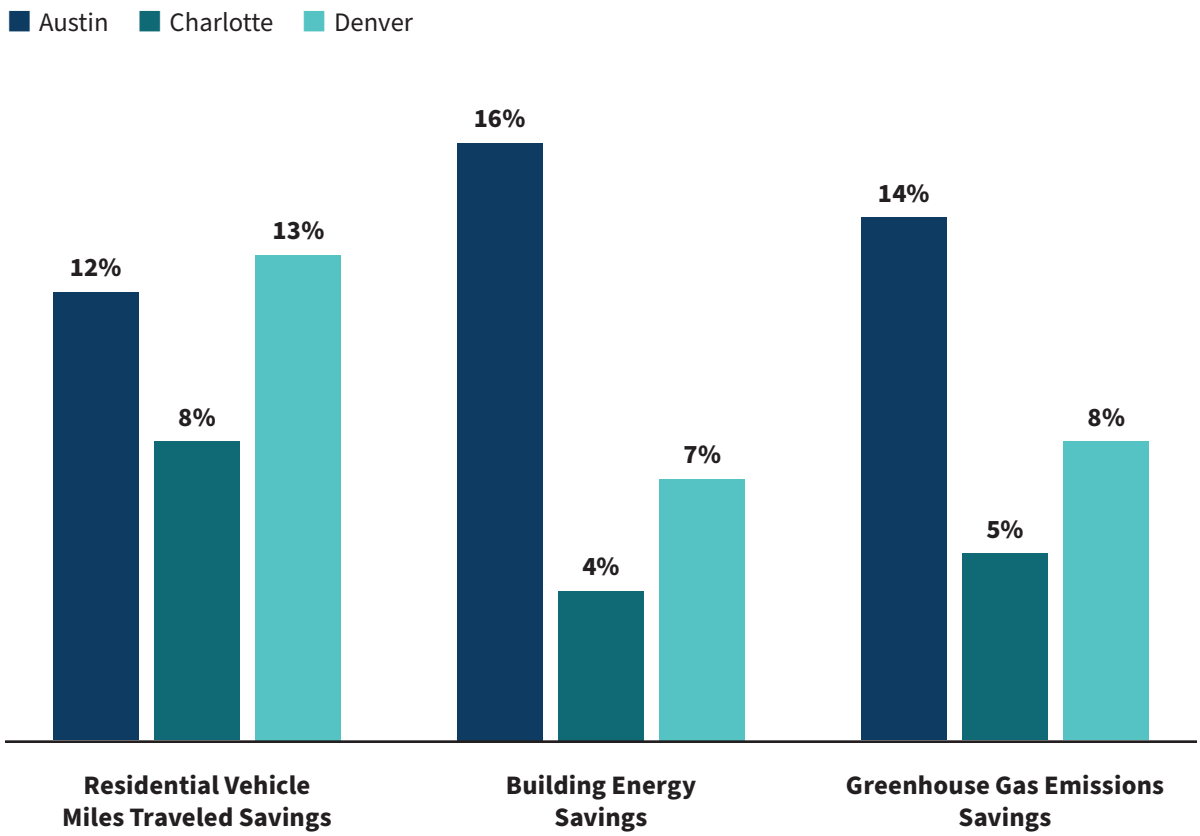
Charlotte	BAU	Reform
	24,088	715
	1,880	3,227

Denver	BAU	Reform
	22,803	21,566
	6,110	8,542



RMI Graphic. Data: RMI and UrbanFootprint

Exhibit ES2 Per Capita Impact of Land Use Reform by Metro Region



Note: Metrics are all calculated as the annual reduction from the business-as-usual scenario to the land use policy reform scenario in 2040. These reductions are calculated across the population of the entire metro region, including both current and future residents. The savings per future resident are much larger. Building energy consists of on-site building natural gas plus electricity consumption. Greenhouse gas emissions consist of building energy emissions from natural gas and electricity generation plus passenger vehicle emissions.

RMI Graphic. Data: RMI

Introduction: The Harmful Legacy and Ongoing Costs of America's Urban Land Use Policies

A Racist Legacy and a Chronic Housing Shortage

Today's urban built environment in the United States is plagued by a long history of discriminatory and racist policymaking to segregate neighborhoods, as well as more recent practices that prioritize the movement of cars over all other forms of transportation.[6]

Federal policies such as redlining reduced property values in Black neighborhoods and constrained non-white households from purchasing homes in white neighborhoods.[7] As suburbanization and the government-subsidized mass production of single-family homes took hold in the 1950s and 1960s, white middle-class households left downtown areas to live in racially and economically homogeneous, auto-centric suburban communities. Many of these communities enforced racial covenants that prohibited selling to non-white buyers, further fueling the country's immense racial gap in homeownership. At the same time, accommodating the exodus of white families to the suburbs meant displacing and fracturing vibrant, diverse urban neighborhoods, with once walkable streets converted into traffic corridors.

Today, despite bans on explicit discrimination in housing access and mortgage lending, exclusionary zoning — policies that govern what can be built and where — has perpetuated the harms of discrimination. While comprehensive national data does not exist, recent regional estimates find 70% to 90% of residential land in US cities is typically reserved for detached single-family homes.[8] A variety of other land use regulations, whether or not explicitly intended to keep specific communities out, have also exacerbated the problem, including minimum parking requirements, lot size requirements, setbacks, and other regulations that effectively prohibit multiunit and more affordable housing types.

As a consequence of these restrictions, the United States faces a cumulative housing shortage of nearly 4 million homes (as of 2019).[9] The continuing lack of housing supply has contributed to a nearly 20% rise in the median housing price between 2019 and 2022.[10] A 2021 analysis deemed housing markets in 80 of the country's 100 largest metropolitan areas inaccessible to low- and moderate-income (LMI) households, up from 60 markets in 2020.[11] The spike in home prices and rents in the United States exacerbates housing-induced poverty and neighborhood displacement. Black families have been hurt the worst, with declining rates of homeownership and continued struggles to afford rents.[12]

Car Dependency and the Biggest Emissions Challenge

In addition to causing decades of housing inequities and a severe housing shortage, urban sprawl continues to be the default growth pattern in the United States, with acres of natural and agricultural lands paved over to accommodate low-density developments and roadways. In the United States between 2000 and 2010, the population grew by 10%, while urban and suburban land use increased by 15%.[13] Including Canada, urban and suburban land use expansion was 15 million acres from 1992 to 2015, accounting for 16% of total global expansion despite the two countries having only 5% of the world's population.[14]

This has forced people to live farther from essential everyday destinations such as workplaces, grocery stores, schools, and green spaces. Between 1998 and 2006, the share of jobs that were more than 10 miles from city centers grew in every region of the country. For people living in high-poverty urban areas, the number of jobs within commuting distance fell by over 14% between 2000 and 2012.[15]

Sprawled communities are difficult and expensive to serve effectively with public transit, which works best when distances are shorter and riders are concentrated. Lack of public transit in turn creates more barriers to mobility and economic opportunity.[16] Without good public transit, it is nearly impossible for those without a personal car to participate in the economy. Car dependency imposes large burdens on LMI households and people with disabilities. The gasoline cost burden for low-income households is more than three times higher than for higher-income households, and households outside major metropolitan areas have gasoline cost burdens that are 25% higher than households within them.[17]

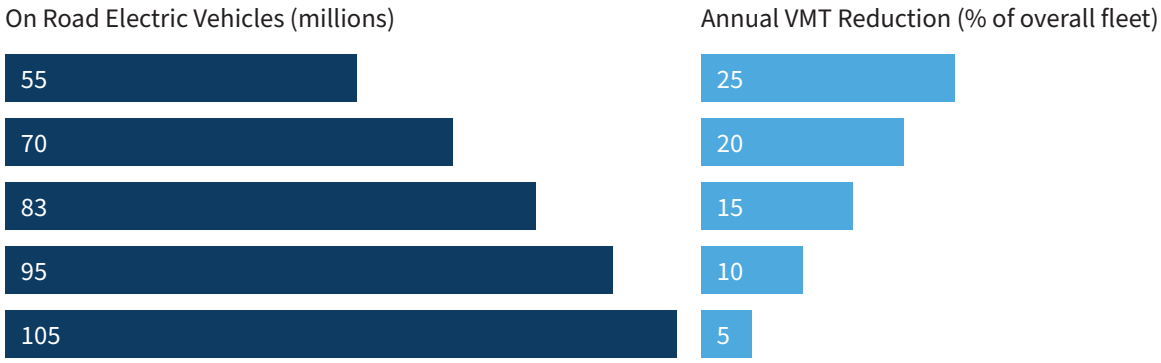
Car-centric development practices also drain the national economy. The New Climate Economy estimates that urban sprawl costs the national economy more than $1 trillion annually.[18] Depending on the location, sprawl increases municipal expenditures by 10% to 40% owing to the added public services needed, including transit and automobile infrastructure.[19] Other studies suggest that government constraints on housing supply in high-productivity metropolitan areas have lowered aggregate US economic growth by as much as 36%.[20]

Beyond the social and economic consequences of car-first development patterns, the present system generates exorbitant greenhouse gas emissions in a pivotal decade for climate action. Tailpipe emissions from on-road vehicles accounted for 23% of the country's greenhouse gas emissions in 2019, not including emissions associated with fuel and vehicle production.[21] US per capita vehicle emissions are 15% higher than Canada's, triple the European average, and six times the world average.[22] Despite improvements to vehicle efficiency, transportation emissions have not shown proportional decreases because the number of miles being driven (also known as vehicle miles traveled or VMT) is increasing. Transportation emissions were on an upward trajectory from 2012 to 2019. Despite a temporary 2020 decline in transportation emissions due to COVID-19, vehicle travel has returned to around pre-pandemic levels.[23]

In 2021, an RMI analysis concluded that the US transportation sector must cut its emissions 45% by 2030 to meet 1.5°C warming goals established by the Intergovernmental Panel on Climate Change.[24] While electric vehicle (EV) adoption is necessary in order to decarbonize the sector, electrification alone is insufficient to achieve this target. Even if the United States achieves the ambitious scenario of putting 70 million EVs on the road this decade, a 20% decrease in VMT per capita would still be needed to achieve transportation emissions reduction goals (see Exhibit 1, next page).

Exhibit 1

Various VMT Reduction and EV Adoption Scenarios That Would Achieve US Transportation Emissions Reduction Goals



Note: This chart illustrates the relationship between vehicle electrification and VMT reduction needed to reach the transportation sector direct emissions target. Considering indirect emissions sources such as vehicle production would enhance the benefits of VMT reduction beyond those shown here.

RMI Graphic. Data: RMI

Other Environmental Costs and Risks

Over 70% of new housing takes the form of detached single-family homes, which use 64% more energy per occupant on average than attached and multifamily homes.[25] Energy savings in multifamily homes result from more efficient use of building space as well as insulation provided by shared walls, which reduces heating and cooling demand. Policies privileging detached single-family homes are an important driver of residential building emissions.[26] Detached homes also tend to emit more carbon per occupant from construction and required materials (not modeled in this report).[27] In this report, energy savings related to buildings are due to compact building form and smaller units. Additional approaches to promote efficient all-electric buildings, integrate solar, and build with low-embodied-carbon materials would further increase energy and emissions savings.

Sprawl also means more roads, power distribution, water and sewage pipes, communications lines, and other infrastructure. This infrastructure brings more carbon embodied in construction materials as well as increased costs, which are often hidden in implicit government subsidies (not modeled in this report). Sprawl also involves converting land from other uses, often turning net carbon sinks, such as intact or well-managed forests, wetlands, and grasslands, into net carbon sources. Urban and suburban development has already reduced the US carbon sink by 78 million tons of CO_2 per year — about a tenth of the current net carbon sink.[28, i]

i Carbon sources add to the accumulation of carbon dioxide in the atmosphere while carbon sinks subtract from it. Sprawl often results in homes being built in locations vulnerable to wildfires, storm surges, and floods.

Land Use Policy Reform as an Overlooked Climate Solution

Land use regulations are often proposed, ostensibly, as measures to enhance public and environmental health (by preventing polluting industries from operating near homes and schools, for example). However, the reality is that these regulations have both effectively perpetuated the legacy of redlining and exacerbated the pollution and carbon emissions that cities desperately need to mitigate.

Despite the benefits of housing policy and land use reform, cities often overlook these strategies as climate and environmental justice solutions. City climate action plans typically treat development patterns and demographics as exogenously determined rather than squarely under the control of local policy.[29] Cities also often ignore the effects that land use policies within their jurisdictions will have on housing and mobility, and thus emissions, outside their municipal boundaries. Restricting development within cities results in development and emissions elsewhere, often in the suburbs or exurbs.

A more subtle flaw in many climate action plans is that emissions reduction targets — when governments have them at all — are often expressed as total, not per-person, emissions. This is problematic because building more housing in compact cities will most likely bring down *overall* emissions by avoiding development in higher emissions suburbs. However, the city's emissions figure will go up according to conventional accounting simply because more people live there. This means that the conventional approaches used to develop city climate action plans are unable to show the benefits of building more housing within cities, and thus new housing is often ignored or underprioritized as an element of these plans relative to its importance.

To combat this misunderstanding, RMI analyzed three fast-growing cities — Austin, Texas; Charlotte, North Carolina; and Denver, Colorado — to understand the true climate impact of reforming land use policies. This analysis provides numbers to local government decision makers to back up the value of land use policy reform and create the foundation for change in their communities. Done well, these reforms can not only support climate action but also address the housing affordability crisis and provide additional economic, social, and environmental benefits.

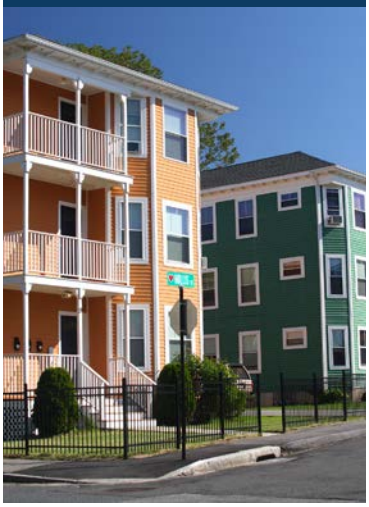
Summary of Analysis

To produce the Austin, Charlotte, and Denver land use policy reform scenarios, RMI used land use mapping software, UrbanFootprint, to model a combined range of upzoning, infill, and transit-oriented development (TOD) policies (see Exhibit 2). For each metropolitan region, RMI used a screening process to find parcels of land throughout the targeted regions that were viable for development or redevelopment. RMI chose the year a parcel's dwelling was built and the relative value of land to structures.[30, ii]

Exhibit 2

Zoning Policies Used in Land Use Scenarios

Upzoning



Allowing multifamily development in residential areas that currently mandate single-family detached housing.

Infill and Redevelopment

Developing vacant and underutilized parcels of land.

Transit-Oriented Development

Redeveloping parcels of land near transit stops to allow for high-density multifamily and mixed-use development.

RMI Graphic

ii Structures are more valuable than land in a healthy housing market, whereas higher land values are associated with a housing shortage and signal latent market demand for new construction. To measure housing market health, we used an improvement to land value ratio. This ratio offers an effective indicator of which parcels are underutilized from a development perspective. Only parcels with homes that were built between 1930 and 2000 and exhibited an improvement to land value ratio of less than 1 were included as sites feasible for redevelopment.

Upzoning

The upzoning elements of the land use reform strategies considered all detached single-family homes within the city that met certain criteria for reasonable redevelopment. These parcels were then converted to duplexes or multiplexes.[iii]

Infill

The infill elements of the land use reform strategies considered large vacant lots, warehouses, and light industrial complexes at least one acre in size and meeting land value criteria. These parcels were converted to three- to five-story mixed-use building types that introduced housing stocks and job opportunities to the area, the blend of which improved density and connectivity.

Transit-Oriented Development

The TOD elements of the land use reform strategies considered the same criteria for underutilized parcels as infill, with a focus on redevelopment of five- to eight-story mixed-use buildings within a half mile of light rail and a quarter mile of high-frequency bus routes (stop times of less than 15 minutes).

To inform the analysis, our team conducted interviews with local public officials, advocates, and planners. As a result, the projected results reflect an educated hypothesis of where the present market has the most latent demand for new housing, and thus where developers would most likely produce new housing. Second, although emissions reduction and avoidance are the primary benefits modeled, RMI sought to account for equity implications by identifying opportunities for multifamily housing in affluent and walkable neighborhoods that have historically seen less development.

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iii Note that many more parcels would need to be upzoned to duplexes and multiplexes to realize the modeled increased capacity, as the likelihood that any individual homeowner would redevelop in a given period is small. The likelihood is expected to be lower for the upzoning strategy than for the infill strategy.

The Climate Impact of Land Use Reform in Three Fast-Growing Cities

RMI chose Austin, Charlotte, and Denver because each city is undergoing rapid population and job growth, with evidence of substantial housing shortages (see Exhibit 3).[31] Furthermore, each city is currently considering zoning reforms that will address these housing shortages. Since many other fast-growing cities in the United States are facing similar housing challenges, the data and lessons from these three cities can also inform other cities' strategies.

Exhibit 3

Housing and Transportation Metrics in Austin, Charlotte, and Denver

City	Population Growth Rate 2010–19	Median Household Income	Rise in Housing + Transportation Costs in 2021	Housing Price Increase in 2021	Median Home Price
Austin	24%	$75,752	47%	30%	$340,000
Charlotte	21%	$65,359	51%	21%	$255,000
Denver	21%	$72,661	42%	17%	$442,000

RMI Graphic. Data: US 2020 census data; US Census Bureau, "Income and Poverty in the United States: 2020"; Housing + Transportation Affordability Index; House Price Index

Pursuing land use reform in these three metropolitan areas could deliver significant environmental benefits, while increasing housing supply to match their forecast 2040 regional population growth.[iv] The analysis found that these reforms can reduce metropolitan region residential VMT per capita in 2040 by 8% to 13% (see Exhibit 4, page 18), relative to business-as-usual (BAU) patterns of development and housing production.[v] Importantly, except where noted, these metrics are averaged over current and future populations; the percentage savings per new resident would be much larger than per current resident.

iv Increasing housing supply to match these regional population growth forecasts may not be feasible without a change in housing policy as ever-expanding sprawl becomes untenable economically, environmentally, and politically.

v The Austin scenarios were through 2045, but impacts for all metrics in this section have been linearly scaled back to 2040 for comparability with the two other cities.

RMI also considered the impact of land use reform on building energy consumption (including electricity) and local greenhouse gas emissions (passenger transportation plus buildings). With these reforms, the annual building energy use per capita in 2040 would be 4% to 16% lower in these metropolitan regions than in the BAU scenario, averaged over both current and future populations.[vi] Combining passenger vehicle and building energy emissions (including electricity), annual greenhouse gas emissions savings per capita in 2040 with land use reforms would be 5% to 14%.[vii]

Across all three metrics, Austin showed the largest percentage reductions. This is because the assumed regional growth scenario for Austin was more pronounced than those for Charlotte and Denver. Because these metrics are regional averages, more intensive growth scenarios allow for greater leverage of better land use policy, leading to larger regional average benefits.

By focusing housing development in or closer to the urban core of cities, these land use reforms would also help preserve land for other uses such as farming, forestry, and natural ecosystems, which collectively make up a net carbon sink. Cumulative land consumption for new development would be reduced by 52% to 82% through 2040 — stacking onto the emissions avoided associated with reduced VMT and household energy consumption (see Exhibit 5, next page). RMI estimated the preserved carbon sequestration potential due to avoided land conversion to be 33,000 to 200,000 tons of CO_2 per year.

In addition to reducing household energy use and land consumption, enacting these policies would help reduce water consumption — a growing imperative across the Sunbelt and the American West. Increasing housing density increases opportunity for shared outdoor space, resulting in less area devoted to lawns and less demand for outdoor irrigation. For instance, single-family homes in California have double the outdoor water use compared with multifamily homes.[32] Across the three cities, the land use policy reform scenario reduced total regional per capita water consumption by 10% to 17%. Taken together, these findings highlight the potential of land use reform to deliver a wide range of environmental benefits.

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vi Building energy consists of on-site building natural gas plus electricity consumption.

vii Greenhouse gas emissions consist of building energy emissions from on-site fuel use and electricity generation plus passenger vehicle emissions. Other than including electricity generation, emissions are only those from direct fuel combustion (i.e., Scope 1), not upstream or life-cycle emissions. Weighted average emissions savings were estimated based on emissions intensities for buildings and passenger vehicles from each state in 2022, retrieved from its respective Energy Policy Simulator model (**https://energypolicy.solutions/**). These emissions intensities are based on today's mix of appliances, vehicles, and electricity generators. Other climate policies and technology improvements may lead to reductions in these intensities by 2040, but keeping 2022 intensities highlights the benefits of land use reform without counting on these other outcomes. First counting the benefits of efficiency and conservation policies such as land use reform is consistent with the "avoid, shift, improve" logic recommended by the Intergovernmental Panel on Climate Change Working Group 3. In any case, changes in intensities would have smaller effects on the percentage emissions changes shown here than absolute magnitudes of carbon emissions.

Exhibit 4

Per Capita Impact of Land Use Reform by Metro Region

City	Residential Vehicle Miles Traveled Savings	Building Energy Savings	Greenhouse Gas Emissions Savings
Austin	12%	16%	14%
Charlotte	8%	4%	5%
Denver	13%	7%	8%

Note: The Austin scenarios were through 2045, but impacts have been linearly scaled back to 2040 for comparability with the two other cities. Metrics are all calculated as the annual reduction from the BAU scenario to the land use policy reform scenario in 2040. These reductions are calculated across the population of the entire metro region, including both current and future residents. The savings per new resident are much larger.

RMI Graphic. Data: RMI

Exhibit 5

Additional Environmental Benefits from Strategic Land Use Policy Reform in 2040

City	Reduced Per Capita Land Consumption from New Development	Preserved Carbon Sequestration Potential (Thousand Tons CO_2 Per Year)	Per Capita Water Consumption Savings
Austin	52%	200	17%
Charlotte	69%	33	12%
Denver	82%	48	10%

Note: In contrast to the VMT, building energy, and greenhouse gas emissions metrics, the land savings percentage applies only to the area of incremental development relative to 2021. Thus, it cannot be compared directly with these other percentages.

RMI Graphic. Data: RMI

In the following three sections, we will review the detailed UrbanFootprint scenario analyses for each of the three cities.

Austin

Background and Context

With a population of nearly 1 million and a growth rate of 3.9% since 2015, Austin is one of the fastest-growing cities in the country.[33] Known for its vibrant music scene, a burgeoning tech sector, and active populace, Austin has struggled to affordably accommodate an influx of people seeking its many attractions and amenities. The area's housing challenges are due, in large part, to a land development code that has not been revised in over 30 years. Today, 55% of the Austin land area is zoned for single-family homes.[34]

Housing construction on East Sixth Street in Austin.
Photo by Greg Anderson

In 2012, Austin City Council passed Imagine Austin, a comprehensive plan meant to guide the future growth, sustainability, and resilience of the city. One of the key tenets of this comprehensive plan was that Austin would work toward becoming more compact and connected by reducing the distances that residents would have to drive between work, shopping, and home.[35] To meet that goal, the city committed to launching CodeNext, a comprehensive rewrite of the Austin land development zoning code.[36] However, after years of community engagement and deliberation, the city's efforts to implement a comprehensive reform have largely stalled, due to a variety of reasons, most notably a lawsuit against the city.

As an alternative to comprehensive zoning reform, the City Council, as well as advocates, has pursued more targeted approaches to increasing housing supply. Of late, the council has approved two policies, although further deliberation is necessary to ensure their full potential. One is a vertical mixed-use policy called VMU2 that allows buildings up to 90 feet high along transit corridors. The second is a policy to allow multifamily and mixed-use development on parcels currently zoned for commercial buildings. Both policies are capable of producing significant housing if implemented to their full potential.

Other policies, however, could potentially limit their impact — in particular, the City of Austin's compatibility standards, which limit high-density development near single-family housing. The policy limits building height and size within 540 feet of single-family housing, affecting over 19,000 otherwise developable properties along Austin's transit corridors. Although the council has considered relaxing that distance to 300 feet (about the length of a city block), this change would affect only 2,830 properties.[37]

Most recently, Austin released its Equitable Climate Action Plan, which reinforces the city's commitment to a low-carbon transportation system.[38] Though it does not explicitly mention zoning reform, the plan clearly lays out ambitions for creating neighborhoods that are less reliant on personal cars. The plan includes three key goals to establish this vision: 80% of new nonresidential development is to be located within the city's activity centers by 2030; 135,000 housing units are to be preserved and built, including 60,000 affordable units, with 75% of new housing located within a half mile of the city's activity centers; and 50% of trips in Austin are to be made using public transit, biking, walking, or carpooling, or avoided altogether by working from home.[39]

Finally, in 2020, voters in the region approved Project Connect, a $7.1 billion transit investment that will deliver light-rail lines, a downtown subway, an expanded bus system, park-and-rides, and an all-electric bus fleet to the Austin area. The project is designed to improve access to essential jobs, healthcare, and education opportunities across the region.[40]

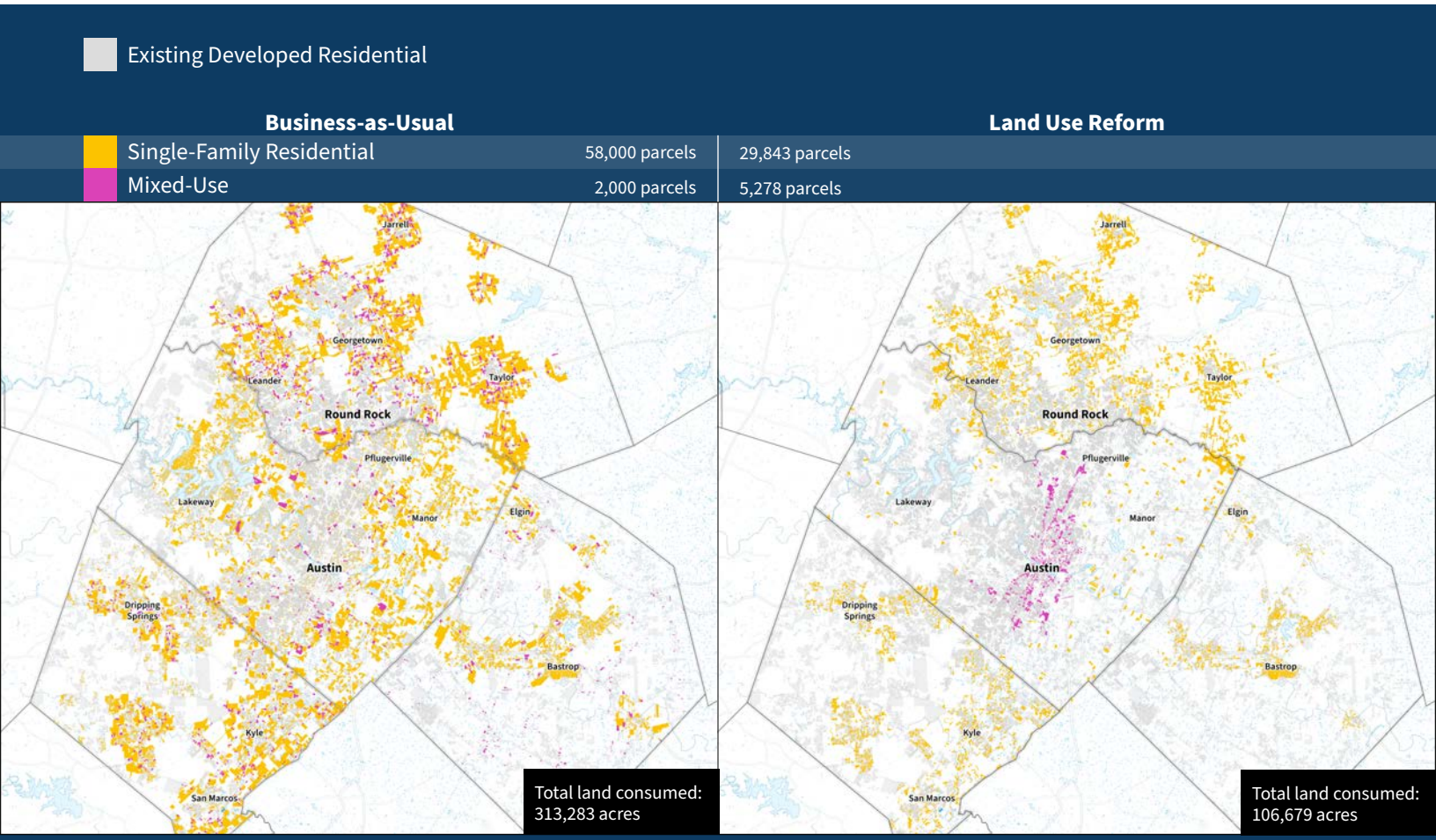
Findings from the Analysis

To estimate the VMT reduction potential associated with land use reform, RMI focused its analysis on upzoning parcels of land adjacent to the existing and future transit system, accounting for new routes and stops. Our team compared the land use policy reform scenario against current conditions and against projections for transportation and land use under a BAU scenario. The BAU scenario was developed using modeling from the Capital Area Metropolitan Planning Organization's 2045 growth forecasts.

The first image in Exhibit 6 (next page) illustrates a BAU projection characterized by significant single-family residential development in suburban areas outside of Austin (represented in yellow/orange). Below, we assigned significantly less residential development to the outlying suburban communities, as well as a high concentration of mixed-use development (represented in pink/purple) in the core of Austin.

RMI modeled the alternative land use policy reform scenario in accordance with the full development potential of the VMU2 and commercial rezoning policies. Our scenario assumes the development of mixed-use buildings up to 90 feet high along Project Connect transit corridors (see Exhibit 7, page 22). Under this scenario, in 2045, per capita VMT within Austin city limits would be 34% lower than that of the BAU scenario, and the overall regional per capita VMT would be 15% lower.

Exhibit 6 **Austin 2045 Growth Forecast: Business-as-Usual Versus Land Use Reform**



For the business-as-usual analysis, our team assumed continued growth in the suburban communities outside of Austin. The alternative analysis is based on significant upzoning and mixed-use development of commercial, industrial, and vacant parcels. Each mixed-use parcel accommodates up to 90-foot (7–9 floors) mixed-use buildings. Under this scenario, in 2045, per capita VMT within Austin city limits would be 34% lower than that of the BAU scenario, and the overall regional per capita VMT would be 15% lower.

RMI Graphic. Data: RMI and UrbanFootprint

The high figure for VMT reduction potential within city limits results from prioritizing multifamily housing on transit corridors and infill development around currently underutilized and vacant parcels in destination- and transit-rich environments. The lower figure for regional VMT avoidance is largely attributable to the limited transit service outside the city and the suburban development patterns of outlying communities. Even after the completion of Project Connect, the light rail and buses will still operate largely within city limits.

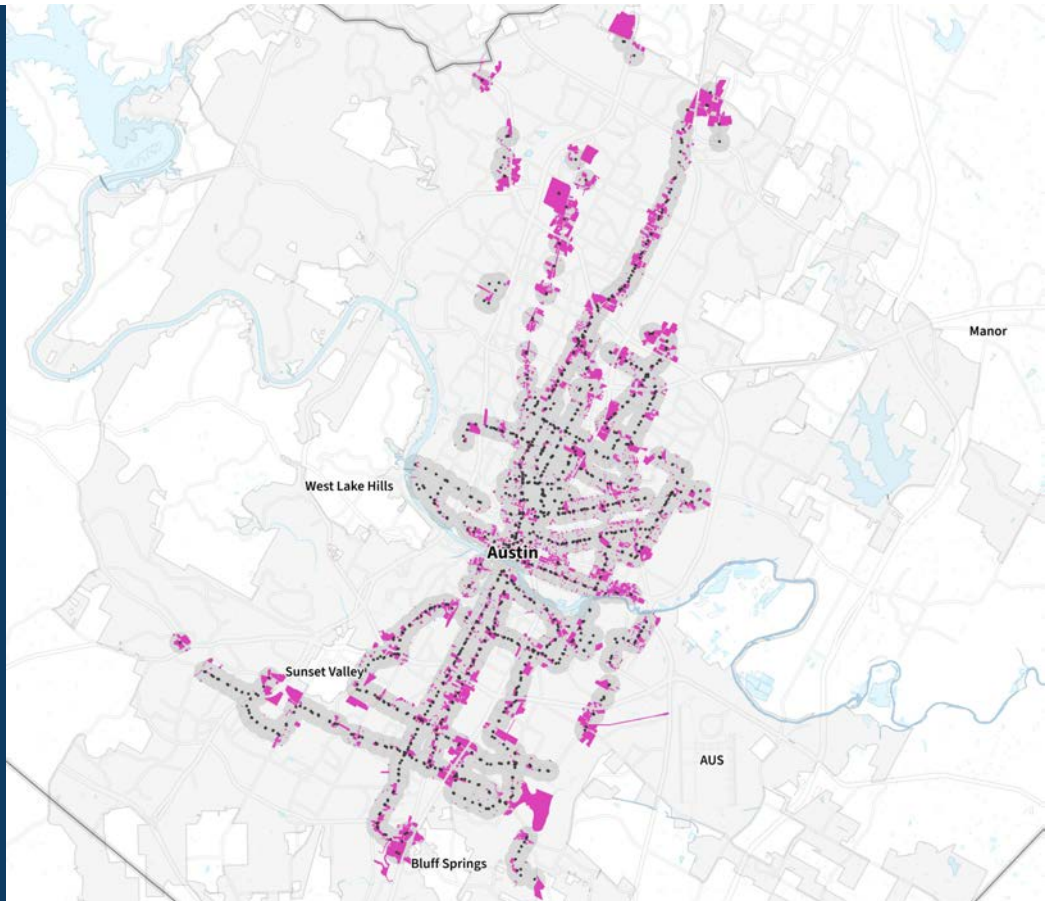
Exhibit 7 **Transit-Oriented Development: Austin's Project Connect Transit Expansion**

TOD Zones
¼-mile buffer around high-frequency bus stops

Mixed-Use Development
5,278 parcels

Austin City Limits

The map to the right shows priority areas for transit-oriented development on key corridors of Austin's Project Connect expansion. RMI's analysis estimates a capacity for 978,000 housing units.



RMI Graphic. Data: RMI and UrbanFootprint

A stretch of North Burnet Road provides a strong example of the opportunity for housing along a critical transit route (see Exhibit 8, next page). The five miles selected in this analysis connect two areas of transit-oriented mixed-use development: The Triangle, to the south, and Austin's increasingly popular Domain neighborhood. In converting underutilized commercial, industrial, and vacant parcels to mixed-use development (represented in pink/purple), this scenario shows the potential to increase housing by 60,000 units.

Exhibit 8 **Upzoning and Infill: Burnet Road, Austin**

TOD Zones: ¼-mile buffer around high-frequency bus stops

	Before Upzoning	After Upzoning
Commercial	205 parcels	0 parcels
Industrial/Warehouse	50 parcels	0 parcels
Vacant/Other	25 parcels	0 parcels
Mixed-Use	0 parcels	280 parcels

RMI identified an opportunity for 60,000 housing units on commercial, industrial, and vacant parcels along Austin's Burnet Road.

RMI Graphic. Data: RMI and UrbanFootprint

Charlotte

Background and Context

With a population of 860,000, Charlotte grew by 21% over the past decade and is one of the fastest-growing metropolitan regions in the nation.[41] This rapid growth was initially fueled by the availability of affordable housing and a strong job market. However, decades of auto-centric development have resulted in sprawling and disconnected communities across Charlotte's great metropolitan area.

Transit-oriented development along Charlotte's LYNX Blue Line light rail. Charlotte Area Transit System photo

The City of Charlotte is going to great lengths to reverse these development and land use patterns. In 2007, the city opened the LYNX Blue light-rail line, which was extended in 2018 and now includes 26 stations across 19.3 miles. To accommodate future growth, the city plans to expand its rail network to include a Silver Line designed to connect the downtown area with small towns to the southeast and with the airport to the west (see Exhibit 9, page 26).[42]

To encourage transit-oriented development along the Blue Line, the City Council adopted TOD zoning districts and rezoned over 1,500 parcels along the light-rail corridor to encourage moderate to high-density, compact, mixed-use neighborhoods.[43]

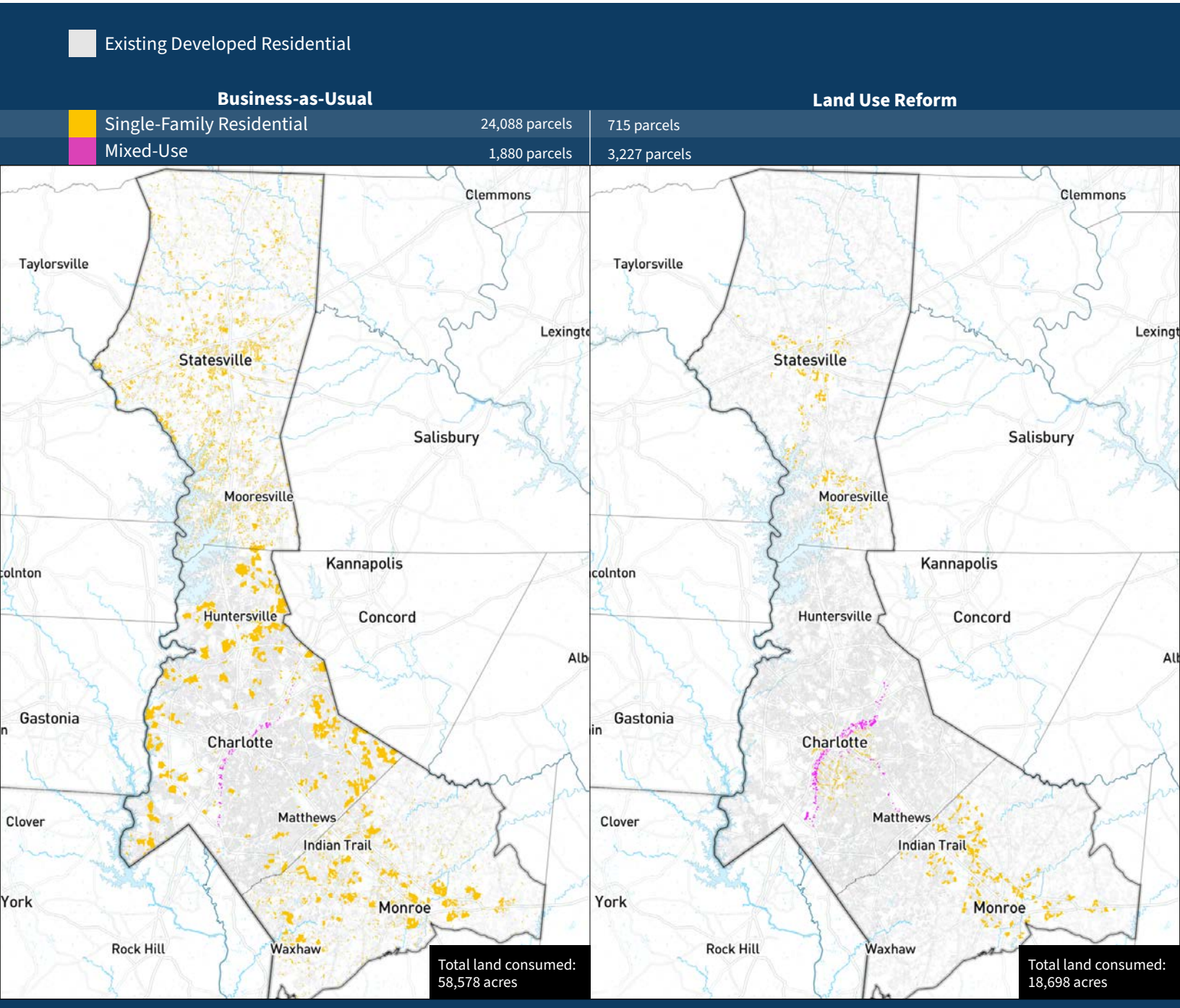
In June 2021, the City of Charlotte passed its 2040 Comprehensive Plan by a narrow vote of six to five.[44] The city's first new comprehensive plan since 1975, it seeks to establish a more compact, walkable, and inclusive Charlotte. It also establishes guiding principles for simplifying existing housing regulations, which amount to over 1,000 pages of regulations that have stymied development and housing in many parts of the city. These guiding principles include major zoning reform that will allow duplexes, triplexes, and accessory dwelling units to be built in single-family residential neighborhoods. The plan also emphasizes the need for development along transportation corridors with the goal of creating 10-minute neighborhoods citywide that provide households access to essential amenities, goods, and services within a 10-minute walk, bike, or transit trip.[45]

Findings from the Analysis

For the Charlotte region analysis (see Exhibit 10, page 27), the project team followed population and employment growth estimates established by the Charlotte Regional Transportation Planning Organization (CRTPO) for 2040, developing scenarios that contrast a BAU approach to accommodating growth against a model. For the BAU analysis, our team assumed that single-family sprawl would continue in Charlotte and its suburbs. The alternative analysis places considerable emphasis on mixed-use development of commercial, industrial, and vacant parcels near transit. In this scenario, parcels that met our methodology criteria were replaced with 90-foot mixed-use buildings close to the city center and with 40-foot mixed-use buildings as transit moved farther from the city's core.

Charlotte posed a unique analytical challenge because even the BAU growth estimates projected by CRTPO will be impossible to achieve without significant reform to land use. Without allowing for more housing on single-family parcels in the Charlotte city limits, development will be forced outside the city.

Exhibit 9 **Charlotte 2040 Growth Forecast: Business-as-Usual Versus Land Use Reform**



For this scenario, parcels were replaced with 90-foot mixed-use buildings within the city center and with 40-foot mixed-use buildings along transit running out of city center. This results in VMT per capita that is 12% lower than BAU within the city and 8% lower on a region-wide scale.

RMI Graphic. Data: RMI and UrbanFootprint

To achieve significant VMT reduction, our analysis shows that Charlotte will need to rely more heavily on upzoning parcels currently occupied by single-family homes, as there are a very limited number of vacant, commercial, and underutilized parcels. For these residential parcels, the land use reform scenario focuses on single-family parcels along key corridors where multifamily development is most likely to occur. It also features significant development along the existing LYNX Blue Line (see Exhibit 10) as well as the proposed (but not yet funded) route for a LYNX Silver Line. Along both light-rail lines, existing development lacks the density to support transit, so the city has a tremendous opportunity to implement targeted land use reform in these areas.

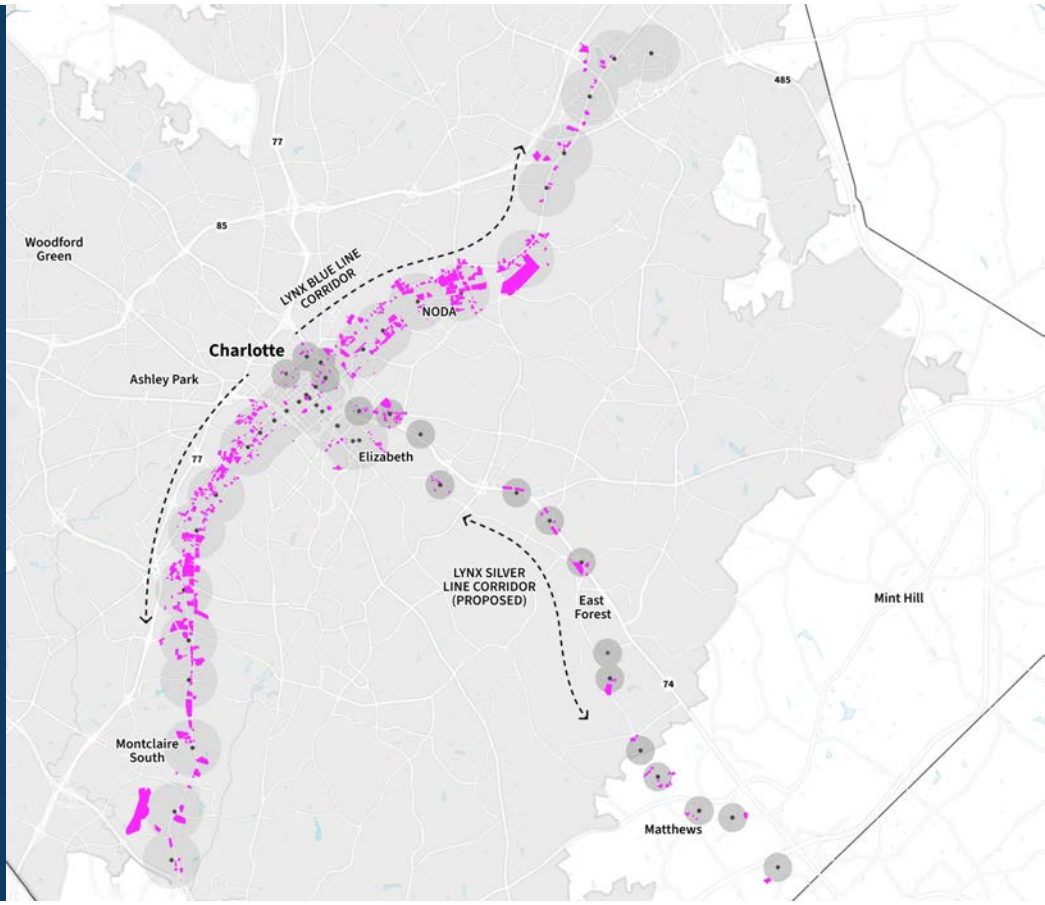
Exhibit 10 **Transit-Oriented Development: Charlotte's LYNX Blue Line and Planned Silver Line**

TOD Zones
½-mile buffer around Lynx Blue Line and ¼-mile buffer around proposed Lynx Silver Line stops

Mixed-Use Development
853 parcels

Charlotte City Limits

For this transit-oriented development scenario, RMI focused mixed-use and multifamily development along the existing LYNX Blue Line corridor, as well as an existing bus route where an additional Silver Line is proposed. This analysis uncovered the potential for 143,000 new housing units.



RMI Graphic. Data: RMI and UrbanFootprint

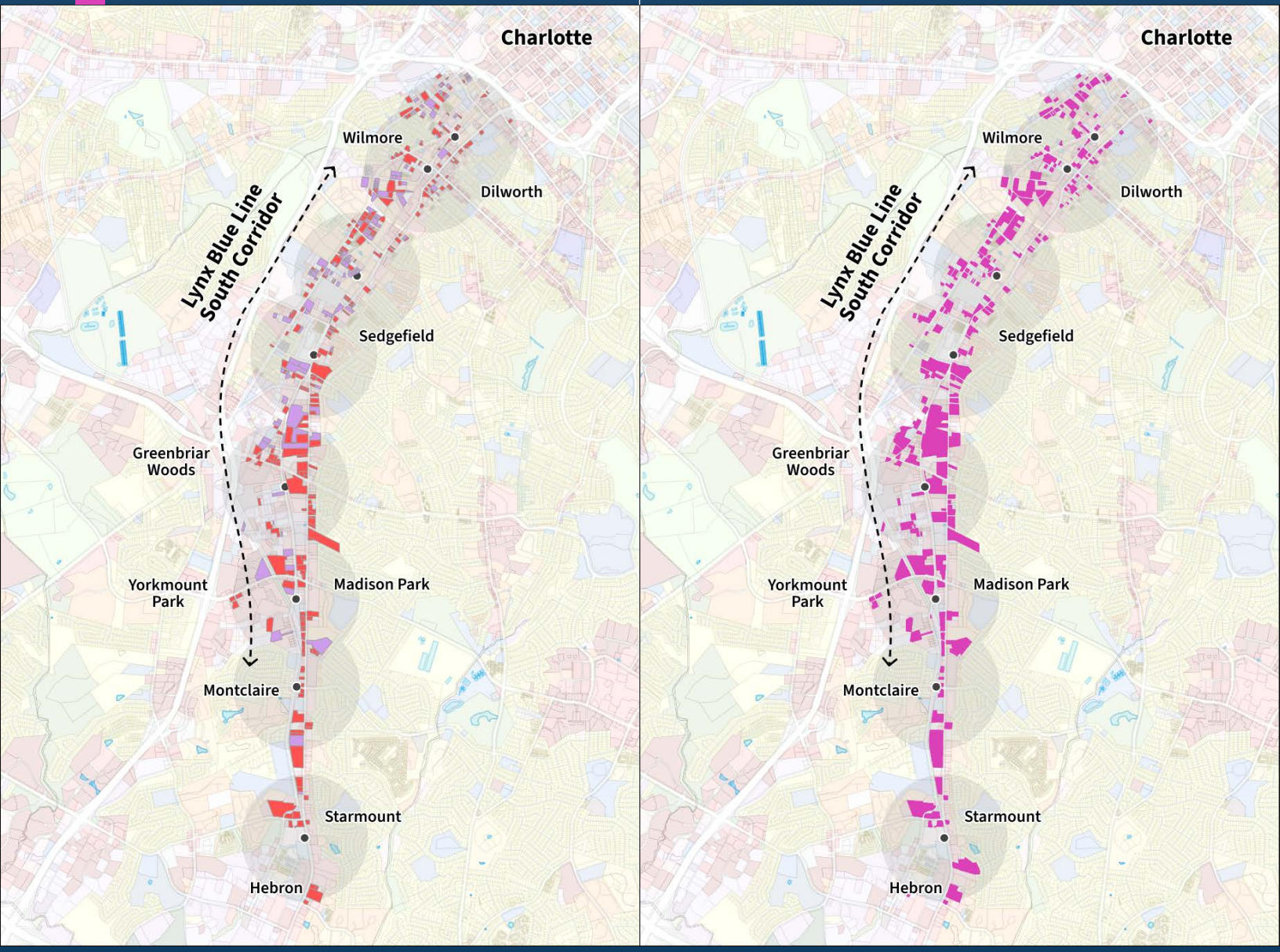
The resulting analysis indicates that under this scenario, per capita VMT within Charlotte city limits would be 34% lower than BAU, and overall regional per capita VMT would be 8% lower.

Charlotte's LYNX Blue Line extends just over 19 miles from the University of North Carolina at Charlotte to the north, through downtown, and to the southern city limits. The segment pictured in Exhibit 11 (next page) represents the southern portion of the light-rail line. Although much development has occurred along this route, significant potential exists to build 50,000 units of housing with direct access to Charlotte's downtown job center.

Exhibit 11 Upzoning and Infill: LYNX Blue Line, Charlotte

TOD Zones: ½-mile buffer around high-frequency bus stops

	Before Upzoning	After Upzoning
Commercial	252 parcels	0 parcels
Industrial/Warehouse	153 parcels	0 parcels
Vacant/Other	0 parcels	0 parcels
Mixed-Use	0 parcels	405 parcels



RMI identified opportunity for 50,000 new housing units along the Blue Line corridor, running through the heart of downtown Charlotte.

RMI Graphic. Data: RMI and UrbanFootprint

Denver

Background and Context

With over 750,000 residents, Denver is one of the fastest-growing metropolitan areas in the country, with a nearly 20% increase in population between 2010 and 2020 and rapid growth forecast to continue for the next few decades.[46, viii]

Passengers wait to board light rail at Denver's Union Station.
Photo by Jeff Wood

Considering this current and anticipated growth, Denver's City Council adopted a new zoning code in 2019 called Blueprint Denver to guide land development until 2040. It represents the first meaningful change to the city's zoning regime since 2002.[47] Blueprint Denver's goal is to create complete neighborhoods, connecting residents with necessary amenities within their block. It relies on a type of form-based code that aims to achieve area-specific characteristics without restricting building types based on an individual parcel's zoning.[48]

Blueprint Denver's goals are not explicitly climate focused, but their impact is expected to change commuting patterns, improve walkability, and create needed density throughout the city. The Denver Metro Vision 2050 Plan, which is a growth framework for the entire Denver region, aligns with Blueprint Denver's goals and includes emissions targets.[49] The Metro Vision Plan departs from many other metropolitan planning organizations by acknowledging the increase in car dependency in the area and defining goals to reduce per capita VMT. It aims to reduce primary trips taken by single-occupancy vehicles by 10% and to reduce per capita VMT by 10% by 2035.[50] It hopes to achieve this by improving transit options and access, encouraging mode shift, and inducing housing and commercial development in areas designated as urban centers.

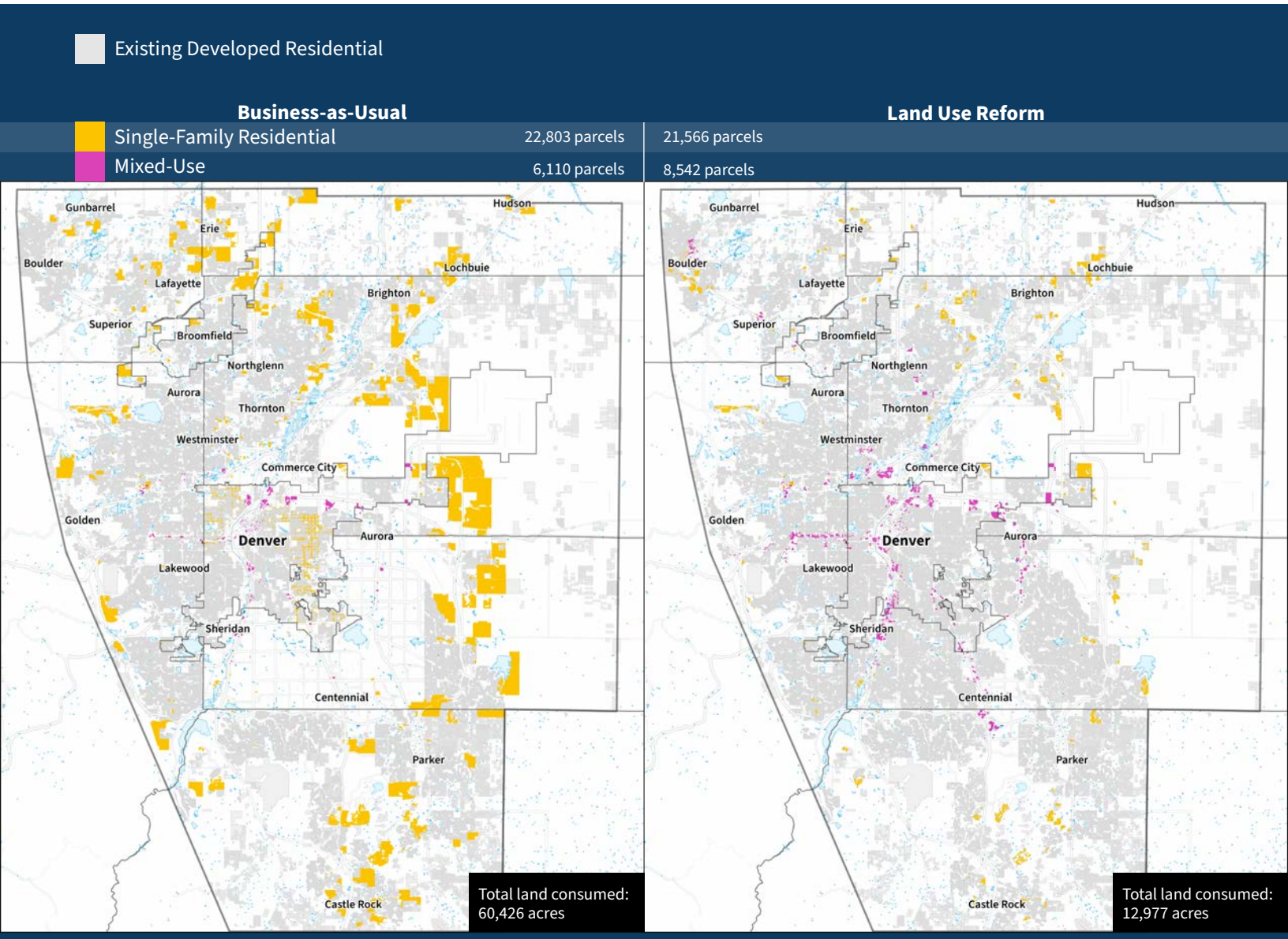
Whereas land use reform is a primary focus of Blueprint Denver and the Metro Vision Plan, the same cannot be said for Denver's 80x50 Climate Action Plan. Introduced in 2018, its policy objectives to reduce transportation emissions focus solely on mode shift and EV adoption. The 2020 follow-up *Denver Climate Action Recommendations Report*, however, offers a corrective.[51] Although this document doesn't guide public policy, its recommendations acknowledge land use as a tool to reduce greenhouse gas emissions. It includes recommendations on equitable TOD policies to increase the supply of affordable housing around high-quality transit.

viii We note that this population growth may not be feasible without the land use reforms modeled in the land use policy reform scenario, though we assume similar population growth in the BAU scenario to simplify the comparison.

Findings from the Analysis

For the BAU analysis, our team assumed substantial growth in the eastern portion of the Denver region (see Exhibit 12, next page). This continues an existing pattern of development near Denver International Airport, as well as south to Parker and Castle Rock. Our land use policy reform scenario relies greatly on TOD along Denver's regional light-rail and bus network.

Exhibit 12 Denver 2040 Growth Forecast: Business-as-Usual Versus Land Use Reform



For Denver's business-as-usual scenario, RMI assumed continued growth of single-family development in emerging suburban communities in the eastern plains. The alternative scenario clusters multifamily housing along RTD's light-rail and high-quality bus lines. This results in VMT per capita that is 12% lower within city limits and 12% lower on a region-wide scale.

RMI Graphic. Data: RMI and UrbanFootprint

The land use policy reform scenario focused largely on TOD and infill development to increase density along Denver's existing and planned transit corridors (see Exhibit 13, next page). Of all the regions considered, Denver has the highest potential for VMT reduction at the regional scale due to the build-out of an extensive regional bus and rail transit system, which extends outside of Denver into Adams, Arapahoe, Boulder, Broomfield, Jefferson, and Douglas counties.

Across the region, ample opportunities for TOD exist in locations that are currently characterized by large swaths of parking lots, strip malls, and other land uses that are ripe for reform. Reforming land use policies to prioritize housing and mixed-use development in these locations would align with the equitable TOD policies and recommendations of the Regional Transportation District (RTD) and *Climate Action Recommendations Report*. More specifically, Denver can work alongside RTD to enable mixed-use development on RTD's surface park-and-ride locations, which would go a long way toward increasing the supply of affordable housing, increasing transit ridership, and boosting the region's tax base.

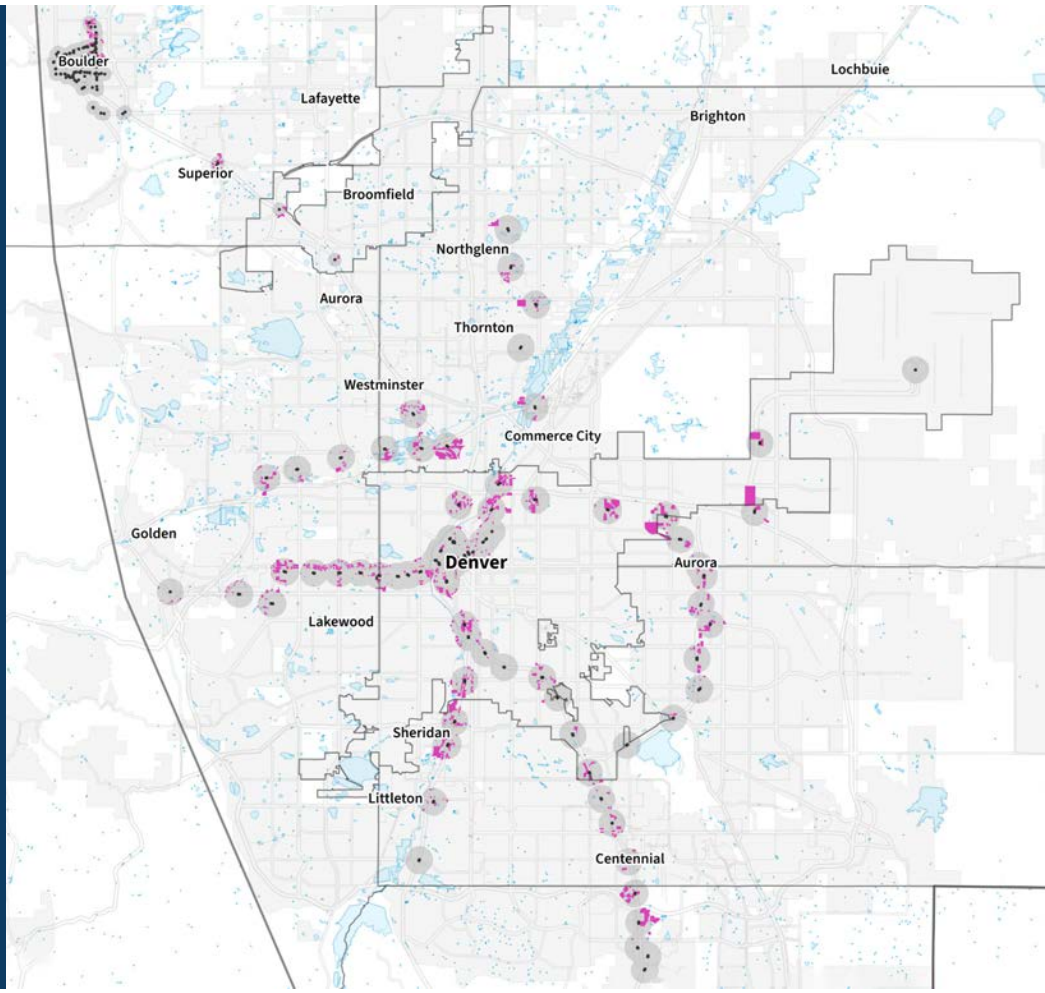
Exhibit 13 **Transit-Oriented Development: The Denver Regional Transportation District**

TOD Zones
½-mile buffer around key RTD light-rail corridors and ¼-mile buffer around proposed high-frequency bus stops

Smart Growth Mixed-Use
1,368 parcels

Jurisdiction Boundaries

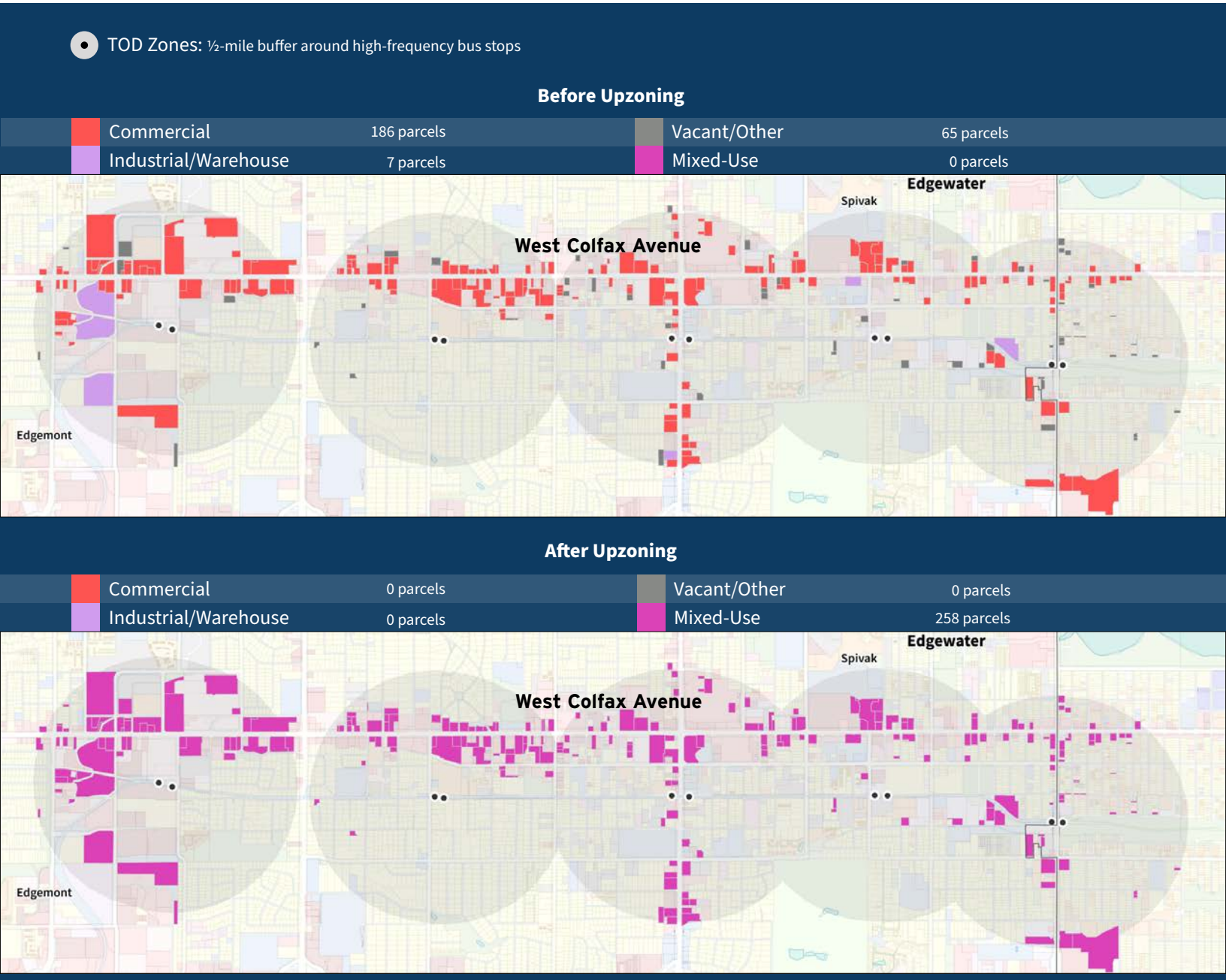
The map to the right shows priority areas for transit-oriented development along light-rail and bus lines within Regional Transportation District (RTD) service territory. For these corridors, RMI identified a potential capacity of 324,000 new dwelling units.



RMI Graphic. Data: RMI and UrbanFootprint

In our corridor upzoning example (see Exhibit 14, next page), we highlight a four-mile stretch of West Colfax Avenue, a critical corridor that runs from Denver west to Edgemont. This segment encompasses a bus route along Colfax Avenue as well as a light-rail line just to the south. Our analysis finds that upzoning the highlighted parcels could produce about 24,500 new dwelling units on around 250 acres all within a half-mile radius of five light-rail stations in Jefferson County.

Exhibit 14 Upzoning and Infill: West Colfax Avenue, Denver



RMI identified potential for over 24,500 housing units along the West Colfax light-rail and bus corridor, running west from Denver to Lakewood, Colorado.

RMI Graphic. Data: RMI and UrbanFootprint

Under our land use policy reform scenario, per capita VMT within Denver city limits would be 11% lower than BAU, and overall regional per capita VMT would be 13% lower.

Analysis and Policy Takeaways

Cities Have Ample Space to Accommodate Population Growth in Their Urban Cores

This study illustrates that metropolitan areas such as Austin, Charlotte, and Denver have ample space to accommodate larger populations within their city limits. The land use policy reform scenarios accommodated over 50% more people in transit- and destination-rich neighborhoods while developing only 0.3% to 3.6% of parcels in each city, corresponding to no more than 2.7% of the total metropolitan area.

Focusing development near transit-rich and walkable locations enhanced reductions in VMT and emissions compared with a more uniform upzoning approach encompassing neighborhoods closer to the average VMT for the metro region.[ix]

In practice, more land would need to be upzoned than explicitly modeled in UrbanFootprint. This study did not conduct a detailed market feasibility assessment or analyze the rest of the housing production funnel.[53] Because only a fraction of upzoned parcels will be redeveloped in a given time under real-world constraints such as private landowner decisions, a larger number of parcels would need to be upzoned in order to realize the level of development modeled here. This means that redevelopment would be spread out in space and over time, minimizing concentrated impacts. Indeed, wide-scale upzoning is likely necessary in order to realize broad affordability and address equity considerations while minimizing large spikes in land values.[54] Nevertheless, the overall conclusion would hold: only a small fraction of parcels need to be developed to deliver the housing production modeled in our land use policy reform scenarios.

Suburban Retrofits: Design Is Critical

Although our land use policy reform scenarios showed significant VMT reductions compared with BAU scenarios, these savings fall short of achieving the necessary 20% reduction in VMT per capita by 2030. The dominant suburban development patterns throughout the regions modeled diluted much of the VMT reduction attainable in the transit- and destination-rich city cores.

Many suburban communities are characterized by fundamentally auto-centric design, such as cul-de-sacs and hierarchical street networks funneling even routine trips onto highways. This design is fundamentally at odds with compact and walkable neighborhoods, and it makes efficient and cost-effective public transportation challenging.

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ix Nonetheless, it is important to keep in mind that uniform upzoning would likely be environmentally superior to no upzoning at a regional scale because with no upzoning, new development would be pushed to the suburban fringe, resulting in even higher VMT than current metro region averages.

To achieve region-wide VMT reduction, we also need to consider wholesale suburban retrofits. Innovative proposals and policies include:[55]

- Colocating commercial and residential uses, building out suburban town centers, and modestly increasing density in nearby neighborhoods to improve walkability, reduce trip lengths, and make transit more viable[56]
- Improving bike and pedestrian infrastructure such as by expanding sidewalks and adding protected or off-street bike lanes[57]
- Publicly acquiring properties to create pedestrian pathways and bike lanes connecting cul-de-sacs[58]
- Establishing e-bike rebate programs, which have proven to be highly popular and successful in offsetting car trips[59]
- Converting general purpose lanes on streets, arterials, and highways to express bus lanes[60]
- Reducing implicit subsidies and providing better pricing signals for the use of public streets and parking, including equitable parking fees and congestion pricing[61]
- Unbundling parking in privately owned housing, retail, and places of employment, for instance by requiring employers to offer cash back to employees who do not use parking[62]
- Pay-as-you drive insurance schemes and vehicle registration fees that incentivize less driving[63]
- Redirecting funding for highway expansion toward highway maintenance ("fix it first"), public transit, and other climate-friendly investments[64]

Rezoning Is Not Enough: We Need to Change Many Land Use Regulations

In some cases, simply rezoning land to allow for mixed-use and multifamily development is insufficient for attaining the level of density and housing capacity modeled in this report's scenarios. Minneapolis, Minnesota, for example, was a first mover in reforming single-family zoning, but the city has seen less uptake of housing than anticipated.[65] In many cases, this is due to additional land use regulation that constrains the height, mass, and buildable area of a development. The most prominent of these constraints are:

1. **Height limitations:** Often justified as a means for preventing obstruction of views or casting shade upon neighboring homes, height limitations are some of the most common means for reducing the total potential of housing in a city.

2. **Minimum lot sizes:** Lot size restrictions inhibit the construction of multifamily developments on rezoned single-family parcels by preventing parcel subdivision. This policy also discourages denser and more affordable types of detached housing. By requiring each home to consume greater land, such a policy steers the market toward larger homes. Overall, this policy constrains density, limiting housing supply and increasing cost.

3. **Minimum parking requirements:** These requirements force developers to include a certain number of parking spaces per housing unit or number of square feet. The result of this policy is most often a building that offers fewer housing units, while using valuable land for vehicle storage.

4. **Floor to area ratio:** These ratios limit the volume, shape, and spacing of buildings. They can be detrimental to building density within a municipality that plans to upzone or spur infill development because they can inhibit parcels from adequately accommodating different development types than what currently exists on the parcel.

5. **Setbacks:** These specify the distance new developments must be between adjacent properties, utilities, roads, and other structures. These "no building" zones have a similar effect as that of minimum lot sizes, where developers cannot use the full area of the parcel, which reduces their return on investment and the likelihood of construction.

6. **Discretionary planning review:** Even when projects meet zoning requirements on paper, they are more expensive or impossible to build because of a planning and permitting approval process that is burdensome, unpredictable, and politicized. Such processes have been shown to privilege unrepresentative community voices that oppose new housing.[66] A better practice is to include extensive, representative community engagement at the comprehensive planning stage and then allow individual projects to be approved "by right" with only administrative review.

Conclusion

Cities, regions, and states have great potential to reduce or avoid emissions over the next two decades through land use reform. This will be no small challenge, given the various policy reforms that need to be enacted to overcome the many barriers to more efficient land use. However, by building broad coalitions — including affordable housing and tenant advocates, real estate developers, environmental nonprofits, local community-based organizations, and others — in a concentrated endeavor to improve the status quo, it is possible.

We need to keep equity considerations at the forefront of land use reform, given the potential for redevelopment to alter a community's dynamics with respect to access, inclusion, and affordability. Ensuring transparent, comprehensive planning processes with input from a diverse, representative group of city residents can improve beloved urban spaces without making them unrecognizable.

As urbanists have long advocated, land use reform can provide cities with tangible social, economic, and environmental benefits in the form of communities and neighborhoods that are rich with amenities, more diverse, better connected, walkable, and more affordable. Our analysis confirms this — and puts numbers to the climate benefits associated with reduced VMT, building energy use, and land consumption. This makes urban land use reform an essential tool for city climate action — as important as sourcing renewable energy, decarbonizing buildings, or electrifying vehicle fleets. Done right, the added benefits associated with housing affordability, equity, health, economic opportunity, and quality of life could be just as significant.

Conversely, the failure to enact intelligent land use reform in growing metropolitan areas will mean locking in all the emissions, costs, health burdens, and frustrations that accompany car-centric development.

> **Too often, cities find that the cause of their problems is prior solutions that have either missed the mark or boomeranged. . . . Our goal should be to solve or avoid each problem in a way that also addresses many more simultaneously — without creating new ones.**
>
> — Amory Lovins, Paul Hawken, and L. Hunter Lovins, *Natural Capitalism*

The findings of this report are a call to action for policymakers, planners, and advocates to embrace housing and compact development as climate solutions. By recentering urban design around human communities and connections rather than cars, roadways, and atomized homes, our cities can once again become places of inspiration.

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