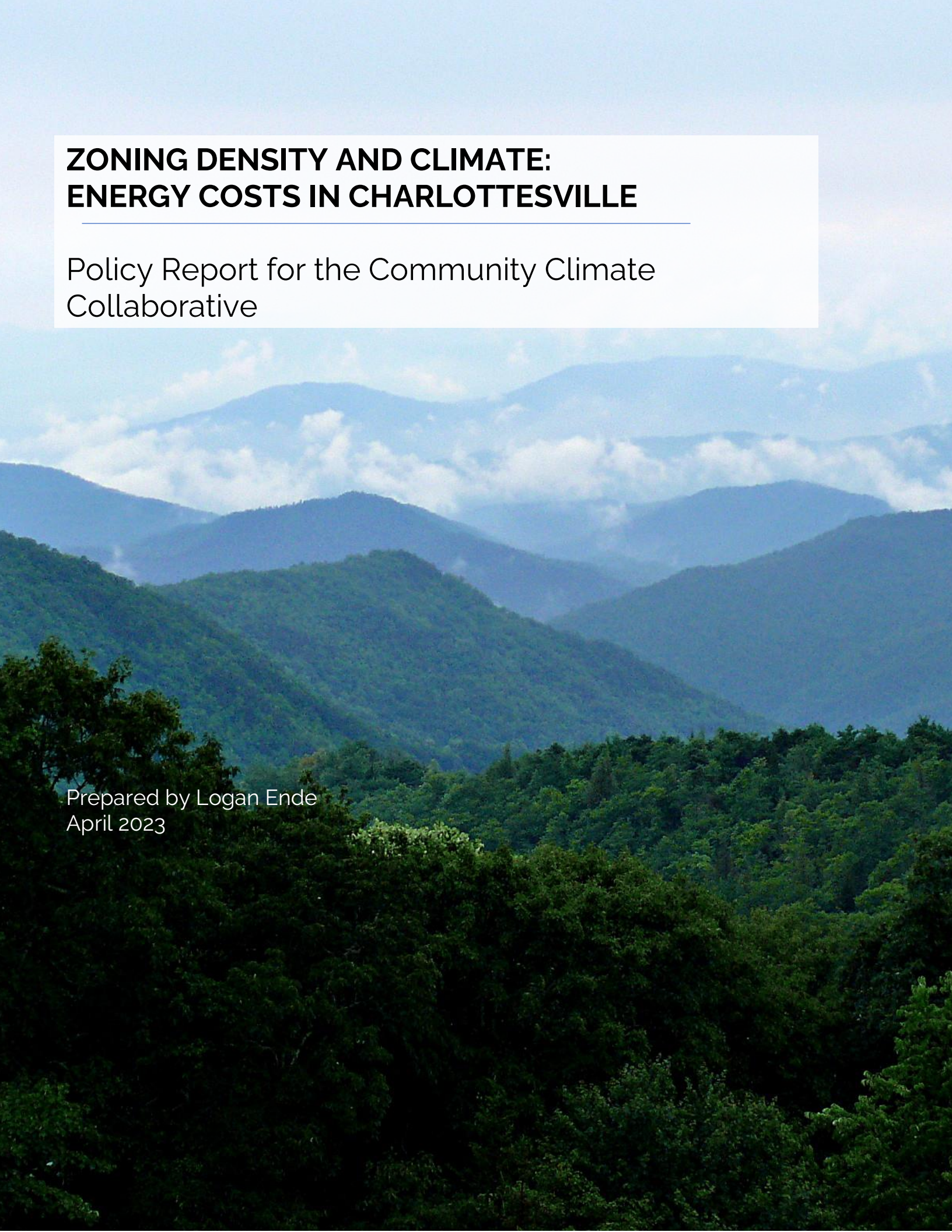
ZONING DENSITY AND CLIMATE: ENERGY COSTS IN CHARLOTTESVILLE

Policy Report for the Community Climate Collaborative



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With gratitude,

Logan Ende

Disclaimer

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Glossary

ADU – Accessory Dwelling Unit
BIPOC – Black, Indigenous, and People of Color
C3 – Community Climate Collaborative
CAHF – Charlottesville Affordable Housing Fund
CLIHC – Charlottesville Low-Income Housing Coalition
CRHA – Charlottesville Redevelopment & Housing Authority
EIA – U.S. Energy Information Administration
HOLC – Homeowner's Loan Corporation
LEAD – Low-Income Energy Affordability Data
PEC – Piedmont Environmental Council
R-1 – Single-Family residential zoning designation
RECS – Residential Energy Consumption Survey
WAP – Weatherization Assistance Program

Executive Summary

Climate change poses a significant threat to the wellbeing and wallets of Charlottesville residents. With rising temperatures, more extreme weather events, and increasing population trends, urban residents everywhere must come to grips with these new challenges. Inequities already woven into the fabric of our city will face exacerbation in the face of rising temperatures and energy costs.

This report was prepared for the C3 as part of their ongoing policy and advocacy work in Charlottesville focusing on residential energy burdens, their root causes, and potential solutions. Charlottesville residents, like many other communities, face high energy costs which can be attributed to a combination of rising temperatures, aging housing stock, and inefficient land use planning. The importance of this issue centers around our future planning to combat climate change, by both reducing emissions and adapting our cities to become more resilient. Charlottesville's ability to build a more resilient and energy efficient urban landscape further impacts the ways in which the city will address its long history of racial, and subsequently economic, inequities.

As the threats of climate change grow and fester, communities must look to smart planning as means of preventing further racial and class-based inequities to grow. This report explored the potential to save residents money on energy costs while also improving housing equity. The report examines three main alternatives to respond to these challenges:

1. Reduce Minimum Lot Sizes for Property Parcels in Charlottesville
2. Eliminate Single-Family Zoning, Establishment of "Missing Middle" Housing
3. By-Right Accessory Dwelling Units

These alternatives were chosen after an extensive literature review and were focused on zoning per the request of the client given the prescience of zoning in the ongoing Comprehensive Plan update in Charlottesville. Alternatives are evaluated according to cost, effectiveness, equity and feasibility considerations. This approach was informed by a holistic review of the political and equity-based implications of historical zoning changes, as well as C3's commitment to environmental justice. Based on these criteria, the report recommends the city and C3 pursue reducing minimum lot sizes and eliminating sing-family zoning, which this paper estimates will reduce energy costs for residents by around 5% in addition to densifying the city by adding new housing units. Implementation of this recommendation involves a community engagement process that submits feedback directly to the City Council through a letter-writing campaign.

Introduction

As our climate continues to change, Charlottesville and its residents will continue to feel an exacerbation of environmental problems related to housing equity and energy efficiency. Too many families in Charlottesville experience unsustainable energy burdens, around 27% of households in the city. The prevalence and unequal distribution of these burdens, predominately in neighborhoods with a higher concentration of BIPOC residents, provided the motivation for C3 to investigate its constituent causes and potential mitigating solutions. This report identifies zoning strategies that serve the dual purpose of reducing energy costs in Charlottesville, as well as promoting housing equity through denser community planning. In doing so, it fills in a gap in local policy analysis by linking energy costs and zoning density. This paper proposes an expansion of single-family zoning to include a maximum of 4 units per lot and simultaneously reducing the minimum lot size to facilitate this transition. Together, these policies are estimated to reduce energy costs for Charlottesville residents by around 5%, as is substantiated in the policy evaluation.

Current zoning structures have proliferated single-family residential zones, exclusionary housing strategies that have perpetuated racial inequities across Charlottesville by lowering the potential amount of housing stock and making a move to residential neighborhoods unaffordable. Minimum lot size requirements, often a subset of single-family zoning ordinances, are one important mechanism through which single-family neighborhoods remain price inaccessible. In examining these drivers of energy costs, the report looks at zoning strategies used across the country to promote density, thereby encouraging smart growth and reductions in residential energy consumption. Next, the presentation will outline three alternatives that build on similar zoning changes found elsewhere in the United States, particularly Portland and Minneapolis, and explores the applicability of their practices to Charlottesville. Using 4 evaluative criteria, the report proposes the alternative strategies and makes a recommendation about the best approach and implementation strategy. These criteria are informed by client priorities as well as traditional metrics relating to zoning. Next, an implementation strategy is considered, weighing stakeholder engagement, local government processes, and best practices from case studies to map a course forward. In addition to the alternatives, the compendium of research is expanded upon in **Appendix G**, which tracks other methods of reducing energy consumption on a municipal level.

Client Overview

The Community Climate Collaborative (C3) are a Charlottesville-based environmental non-profit 501(c)(3) focused on climate action on the community level in Charlottesville and Albemarle County. C3 helps advance community-led climate solutions through local policy advocacy, grassroots education, dynamic cross-sector partnerships. Founded in 2017, the organization has worked extensively to promote climate and energy consumption awareness in the city with initiatives such as the Green Business Alliance, a leadership group of businesses committed to reducing their climate impact and pursuing policy recommendations to advance clean energy. As part of Charlottesville's Climate Action Planning Process in 2019, C3 provided a series of

recommendations that emphasized energy equity and climate-smart zoning. The Climate Action Plan was formally adopted as an amendment to the city's Comprehensive Plan in 2022, providing a framework for a targeted 45% reduction in carbon emissions by 2030 and carbon neutrality by 2050. July 2020, C3 published their Uncovering Energy Inequity report, which analyzed U.S Census data to track energy burdens across Charlottesville, tracking disproportionate costs to low-income households. Through their sustained leadership in the field of community-informed climate action, C3 have been instrumental in guiding local climate policy. This report seeks to support C3's work by identifying zoning solutions that both seek to reduce the inequitable distribution of energy burdens and to facilitate the city's achievement of its bespoke climate goals.

Problem Statement

Energy burden is defined as the percentage of income a household spends on energy bills; energy burdens are considered unsustainable if they comprise more than 6% of a household's annual income (De Campos Lopes, 2020) (Kent, 2020). In Charlottesville, low-income families make around $47,700 per year, meaning that 6% of their income comes out to roughly $2,860 per year in energy costs but could be as high as $9,500 (HUD, 2020) (*Charlottesville, Virginia Data USA*, 2020). According to the Department of Energy's LEAD Tool (Low-Income Energy Affordability Data), the average energy burden for low-income households in the United States is 8.6%, which is almost three times greater than the corresponding energy burden for non-low-income households (DOE, 2018). Solar energy, a net zero energy technology that can create localized energy grids, has been linked with efforts to reduce energy burdens in these households and create a degree of energy independence (Ardani et al., 2021) (Mishra, 2021). However, barriers for low-income households acquiring solar energy include up-front costs of enrollment in a solar energy program, credit scores, lack of private roof space in shared dwellings, and added costs in roof investment (Bovarnick & Johnson, 2017). The racial distribution of these energy burdens fits into the pattern of growing wealth disparities between low-income and wealthy citizens in the United States, informing a similar gap in wealth between minority and white communities (Brown et al., 2020) (Sunter et al., 2019) (Farrell & Lyons, 2016). According to the U.S. Energy Information Administration, a little over 20% of households in the US report forgoing some of their basic needs like food and medicine to pay energy bills at some point during the year (EIA, 2015). Another consideration for these communities is the prevalence of households renting their home, where the landlord would pay for the installation of the technology but would see little if any benefit in terms of savings, though they may be able to charge higher rent. Overall, low-income communities tend to live in older housing stock, meaning their homes and apartments require more energy to heat and cool than newer, more efficient buildings, which tend to be occupied by wealthier, whiter demographics (Drehobl & Ross, 2016).

Without intervention, low-income Charlottesville residents will continue to be cost burdened by energy inefficient residences, contributing to the city's burgeoning carbon footprint and lack of affordable housing. **Around 5000, or 27% of households in Charlottesville experience unsustainable energy burdens.** These homes are not

evenly distributed – in the census tract containing the 10th & Page and Venable neighborhoods, 54% of homes are energy burdened (de Campos Lopes, 2020). Additionally, around one third of the total homes labeled "extremely energy burdened", meaning an energy burden of 20% or greater, were located in these neighborhoods (de Campos Lopes, 2020). Low-income families in metropolitan or urban areas experience twice as much energy burden as the national average household (Drehobl et al., 2020). Generally speaking, Virginia has lower percentages of energy burdened residents compared with states in the Southeast and is more comparable to other Mid-Atlantic states like Pennsylvania. Of low-income households, 67% of them face high energy burdens; additionally, Black, Hispanic, Native Americans, renters, and older adult households are all identities that correspond to higher energy burdens than the national median household (Drehobl et al., 2020).

Background

Urbanization in Charlottesville

Humans are expected to increase in population by 2.5 billion people between 2018 and 2050, with populations in North America expected to increase in urbanization by 7 percentage points over the same period of time (*World Urbanization Prospects*, 2018). In Charlottesville, the population is expected to reach 49,691 by 2050, an 8.7% increase (*Virginia Population Projections*, 2022). In light of these trends in population and urbanization, spatial patterns of urban development are of great importance with respect to guiding the future of our urban spaces. Conventional wisdom of sustainability presents denser urban planning as a responsible trajectory for planning community growth as opposed to indefinite urban sprawl.

Urban population density has long been anecdotally and empirically linked with residential and transportation-related energy efficiency (Kaiser & Barstow, 2022). Estimates show that an increase in population-weighted density is associated with a reduction in household carbon emissions as well as a reduction in transportation emissions associated with a denser urban landscape which would necessitate fewer vehicle miles traveled (Lee & Lee, 2014). More specifically, this trend can be traced beyond population-based statistics and can be found in relation to housing type. When controlling for age, households in multi-family housing units use less energy for heating, cooling, and general consumption than single-family detached homes (Holden & Norland, 2005). This trend can be attributed largely to shared walls and smaller floor area for multi-family homes, which necessitate less energy for air conditioning and are better insulated from their environment by the surrounding housing units. In practice, U.S. Residential Energy Consumption Survey (RECS) data show single-family detached homes use 54% more energy for heating and 26% more for cooling than their multifamily unit counterparts (Ewing & Rong, 2008). Similarly, a doubling of home size in terms of floor area is associated with 16% more energy consumed for home heating and 13% more energy for cooling (Ewing & Rong, 2008)

Climate Change and the Urban Heat Island Effect

Human consumption of fossil fuels has gradually warmed our Earth through the greenhouse effect primarily facilitated by an increase in atmospheric carbon emissions. The impacts of anthropogenic climate change are vast and include changes to biodiversity, public health, agricultural production, and ecosystem services. Estimates show that global temperatures are set to rise by 3 Celsius by 2100, a figure which is primed to balloon depending on our inability to reign in greenhouse gas emissions. (*Climate Hazards,* 2021). Research suggests that the hottest urban areas coincide closely with resource-limited communities and residents of color, underlining the importance of environmental justice in the discussion of climate action (Voelkel et al., 2018). This pattern of heat inequity is called the urban heat island effect. This effect is derived primarily through a lack of tree canopy and prevalence of impervious surfaces like concrete in historically under-resourced neighborhoods (Hoffman et al., 2020). Impervious surfaces like roads and buildings absorb short-wave solar radiation and re-emit it as long-wave radiation, thereby converting solar radiation into heat, amplifying ambient air temperatures. In the summertime, electricity demand for cooling increases 1.5-2.0% for every 1˚F increase in air temperature, which implicates urban heat island effects as a driver of energy costs and inequities (Akbari, 2005). Urban typologies with more exposed roadways and building surface area will often hold onto this heat into the night was well, exposing residents to dangerous hot evening temperatures strongly associated with high mortality risk from stroke (Murage et al., 2017). Green spaces are consistently more prevalent in wealthier, majority white neighborhoods, leaving minority and low-income communities with a disproportionate heat challenge (Nesbitt et al., 2017). Urban planning has its own insidious history with low-income neighborhoods and roadways. The 20th century saw many urban renewal and infrastructure projects take place in low-income neighborhoods, often funded by federal programs (Hirsch, 2009) (Rothstein, 2018). These included massive interstate highway projects which were placed through redlined neighborhoods, dividing communities of color and further devaluing property. This development was often accompanied by large housing complexes and industrial buildings, which were built with high-density materials like cinderblocks, retaining comparatively more heat (Zuk et al., 2018) In addition to the asphalt and concrete from large roadway projects, these buildings contributed to the urban heat island effects by holding onto heat at night.

There are numerous interlocking pieces that comprise the complex issue of climate change and its exacerbation of geographic inequities. One manifestation of this issue is found in negative health outcomes for residents from extreme or prolonged heat exposure. Asthma and heart disease are both issues linked with the urban heat island effect and racial segregation across the modern city (Juarez, 2022). Extreme heat is responsible for more fatalities in the United States over the past few decades than any other hazardous weather event (Hoffman et al., 2020) Extreme heat during summertime is a leading cause of morbidity particularly in communities with pre-existing health issues such as cardiovascular disease, which most often maps onto resource-limited, elderly, and marginalized residents (Borden & Cutter, 2008) (Hess et al., 2014).

Urban Heat in Charlottesville

In 2021, Charlottesville completed an analysis of the local urban heat island effect using citizen science in order to map these effects across the city, seen in **Figure 1** (*Heat Watch Report*)**.** Cooler neighborhoods appear to be ones like Greenbrier and Barracks/Rugby, which feature wealthier, whiter demographics.

Figure 1: Urban Heat Island Effect in Charlottesville, VA 2021

Source: *Heat Watch Report for Charlottesville*. (2021). CAPA Strategies.

Considering the overlapping histories of racial segregation and historic redlining, there is a clear path that connects negative health outcomes, urban heat effects, and high energy costs together. Redlining specifically refers to a discriminatory mortgage lending practice perpetrated by the Home Owners' Loan Corporation (HOLC), a federal housing agency created in 1933 as a part of the New Deal, in which the agency refused to provide loans in neighborhoods deemed "hazardous". However, the term has come to embody most any form of exclusionary housing practice in the United States. In a survey of over 100 cities, formerly redlined neighborhoods were found approximately 5 degrees hotter in summer on average than neighborhoods that were approved for housing loans (Hoffman et al., 2020). Racial covenants were a widely accepted housing practice that excluded residents across Charlottesville and Albemarle from owning a home based on race. These sorts of exclusionary practices were prevalent in Charlottesville for about 50 years, from 1897-1948 (Yager, 2019). In 1948, the Shelley v. Kraemer Supreme Court case struck down years of legally enforceable racial covenants that were baked into the deeds to homes across Charlottesville and Albemarle. This did not stop exclusionary housing practices, however, and it wasn't until the 1968 Fair Housing Act was passed that it became illegal to exclude residents from neighborhoods through other means like private sales or realtor fees.

This has allowed inequities to grow, not just along racial lines in the city, with white families having access to equity and wealth through homeownership at higher rates, but through the quality of housing stock itself (*The Impact of Racism,* 2020). These same disparities are apparent between renters and homeowners, a divide which has implications for financial stability and housing burden. A 2016 report indicates that extremely low-income households in Charlottesville comprised the smallest share of homeowners at 10% and only 24% of these families owned their own homes (*Comprehensive Housing Analysis*, 2016). A report from the Community Climate Collaborate found that nearly 75% of the total cost-burdened households in Charlottesville were renters and 85% of cost-burdened households in the city had an income lower than 90% of AMI (de Campos Lopes, 2020). As mentioned, there is a clear racial disparity in homeownership. Black residents in Charlottesville were about 31 percentage points more likely to report housing costs as being unaffordable compared with white residents (*Comprehensive Housing Analysis*, 2016).

<u>Zoning as a Land Use Tool</u>

One tool that has the power to connect these constituent causes is zoning. Zoning allows municipalities to control where and how development takes place and can provide residents with greater access to new, affordable homes if executed correctly. Exclusionary zoning, the practice of limiting the types of housing and land use options, has long been a tool to segregate Charlottesville (Robertson, 2021). Single-family zoning was born from a desire to keep cities segregated by keeping other types of people and homes out to protect property values. Even in cases where zoning was not explicitly based on racial discrimination, it has had a comparable effect, with de facto segregation characterizing many single-family neighborhoods (Webster & Furth, 2022). By the end of legal racial exclusion via racial covenants, city officials had zoned Charlottesville so to protect the white, single-family neighborhoods by separating them from multi-family residential use or development (de Campos Lopes, 2020). This de facto segregation

persists today and is an important cause of energy burden inequities in the city thanks to the spatial distribution of energy-inefficient homes and heat island effects (see **Appendices H and I)**..

Zoning has roots in the United States going back to the early 1900s when municipalities first began to exercise some measure of control over private property through the use of zones. These various zoning ordinances were upheld as constitutional by the Supreme Court in the now famous *Village of Euclid, Ohio v. Amber Realty Co.* in 1926 and have become the prevailing tool of land use management in the country. As mentioned, zoning is often exclusionary in nature, prescribing in sometimes painstaking detail how property can be used, banning certain types of housing in favor of others. In addition to exclusionary zoning, land use zoning, which demarcates land for residential, commercial, or industrial use, has been used to protect white-home owners and their assets (Rothstein, 2017). Industrial parcels of land were often placed in close proximity to non-white neighborhoods, permanently altering the housing market of these residential areas and jeopardizing the health of their inhabitants (Rothstein, 2017).

Upzoning, which means increasing the permissible density for a particular zone, has a few potential drawbacks. According to a natural experiment in Chicago where upzoning took place between 2013 and 2015, property values rose, which is of net benefit to the city and is one of the explicit purposes of zoning – to improve property values writ large. However, there is evidence that housing prices feature a related increase in the short term in the neighborhood of 15% (Freemark, 2020). These increases in land values have been a subject of debate amongst scholars as to the potential displacement effects of upzoning. Two schools of thought exist broadly, one that attributes rising land values to displacement of residents through pricing mechanism such as increased rent, and another that sees the subsequent increase in housing supply as a remedy for any displacement that may occur. In California, SB 50, which was ultimately struck down in the state Senate, included a number of provisions to prevent unwanted displacement effects of upzoning. These included restrictions on the demolitions of buildings that had been designated affordable or who had been occupied by renters for more than 7 years and further provisions for inclusionary zoning, requiring developers to bake affordable units into new development (Nolan, 2019).

Another tactic for planners in Charlottesville could be to reduce or eliminate minimum lot sizes. This could also include new rules surrounding accessory dwelling units (ADUs), the expansion of which would increase density by allowing the use of a garage, shed or other secondary structure on a property to be used as a dwelling unit. Minimum lot sizes specify how large at minimum a property must be in a given zone. For example, the minimum lot size for R-1 single family zoned properties in Charlottesville is 8,000 square feet. Further designations exist, such as R-1(S) that allow for smaller lot sizes but require a change in zoning designation. These minimums establish a precedent for large houses on larger lots which incur higher energy demands, decrease affordability, and reduce urban density. Larger lots lead to sprawl, which runs counter to the goal of reducing energy costs and carbon emissions. A new study from George Mason specifically implicates the use of minimum lot sizes as a source of increased housing prices due to increased property size and decreased urban density (Gray & Furth, 2019).

Cities that use these minimum lot sizes often have a number of homes clustered right at the minimum size, which suggests that the housing market would accommodate smaller lots and denser communities in the absence of these minimums (Gray & Furth, 2019). Upzoning and addressing minimum lot sizes show promise from the literature in reducing housing costs and increasing residential density, both factors in addressing underlying causes of energy burdens in the region.

Energy consumption and greenhouse gas emissions are inextricably linked to housing type. A 2008 study found that single-family detached, or R1 residential zoned homes, use 54% more energy for space heating and 26% more for space cooling than similar sized households in multi-family structures, such as apartments (Ewing and Rong, 2008). This phenomenon plays out on two different scales. The individual household saves energy from sharing walls and reducing the number of windows per unit in transitioning from a single-family to a multi-family dwelling. Zooming out, municipalities with less sprawl, meaning a denser urban planning structure, pay more in residential energy costs relative to residents of more compact urban communities due to the increased urban heat island effect (Ewing and Rong, 2008) (Singh and Kalota, 2019). Additionally, single-family detached homes have been found to produce 33% more greenhouse gas emissions than single-family attached homes and 150% more than multi-family units (Andrews, 2008). Urban planning, then, plays an important role in determining operational energy consumption by controlling the types of dwellings built and where they are situated, specifically through zoning (Rickwood et al., 2008)

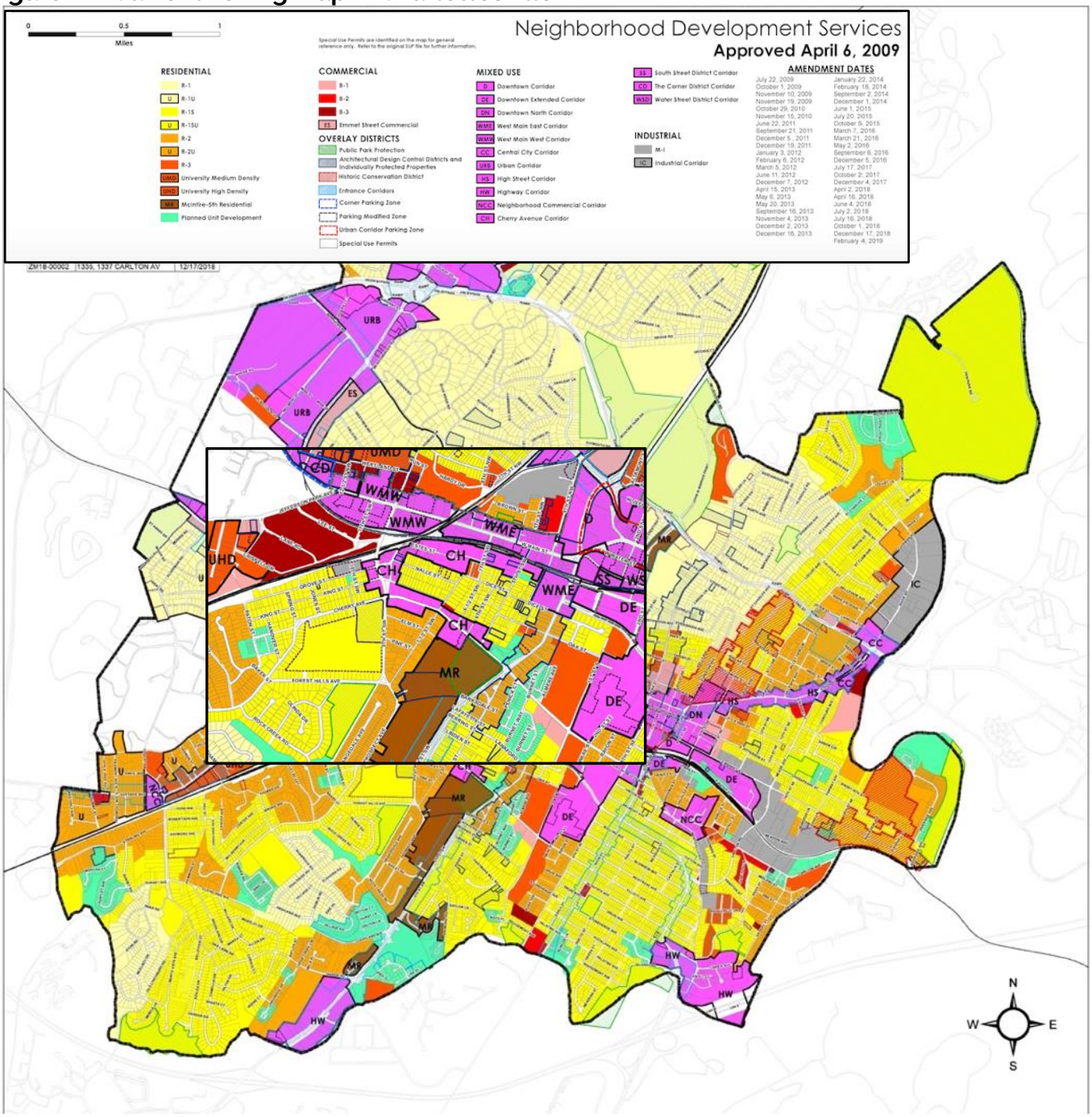
Zoning in Charlottesville

The current zoning strategy, adopted in 2003 when the zoning ordinance was last formally updated, use more conventional tools of planning to manage land use. The majority of the city can be categorized under one of three umbrella terms: “residential”, “commercial” and “industrial”. These zones specify the type of use and intensity of that use for land filed under those designations. **Figure 2A** displays the current zoning map and **Figure 2B** provides information on the differing zoning classifications. While there are areas of mixed-use zoning, corridors that combine residential and non-residential uses either in a single building or across the zone, conventional zoning predominantly dictates the density of Charlottesville.

In 2020, Charlottesville was granted permission from the state (via the Dillon Rule) to implement an inclusionary zoning policy (O’Hare, 2022). Currently, the 2023 zoning ordinance rewrite is underway, navigating a period of public comment facilitated by Cville Plans Together, which is a collaborative, multi-year initiative to make information and public input more accessible to citizens of Charlottesville. Currently, the draft zoning ordinance only includes “Module 1”, which details the specific zoning districts included in the new zoning map as well as parcel setbacks and lot sizes. “Module 2”, which became available for review in March of 2023 and includes development standards. Zoning ordinances are officially adopted by the city and become law when they are recommended to the council by the Planning Commission and then receive approval from City Council. City Council needs a simple majority (3/5) to pass the zoning code, but have the ability make amendments themselves ad hoc, as was the case in

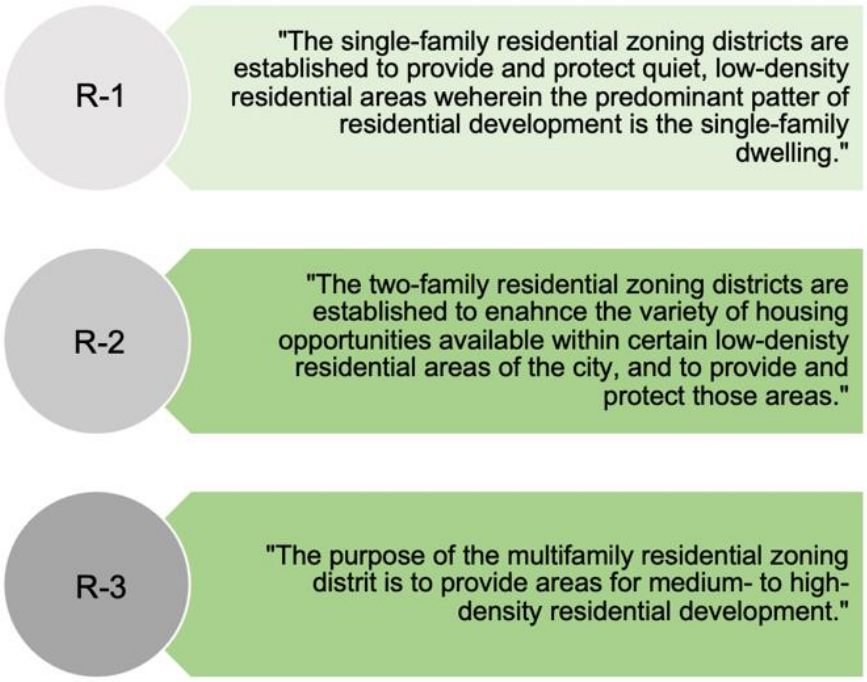
2003, the last zoning rewrite. The Planning Commission and its work in gathering public feedback is ongoing, a feature that must be leveraged within a narrow policy window – public comment will close later this summer as the commission finalizes its recommendations.

Figure 2A: Current zoning map in Charlottesville



Se: *City of Charlottesville Zoning District Map*. (2009). [Map]. https://www.charlottesville.gov/DocumentCenter/View/475/Zoning-Map-PDF

Figure 2B: Descriptions of Charlottesville major zoning categories



Source: Charlottesville, VA., Zoning Ordinance Chapter 34, Article III.

There is also an inclusionary zoning analysis in the draft process that is designed to analyze how the city's housing market may respond to changes in zoning. These policies are related to inclusionary housing efforts would expand availability of units designated as low-income units as part of new construction to a people at 60% of the median area income ($56,220). These changes will have massive implications for my recommendations as they could be superseded by these changes or rendered politically untenable, at least in the short term while changes are being made and monitored.

Alternatives

Policy Option 1: Reduce Minimum Lot Sizes for Property Parcels in Charlottesville

Minimum lot sizes stipulate the smallest size a parcel of land can be in a given area. These restrictions lock low-density neighborhoods into place, preventing homes being built in close proximity. A reduction of minimum lot sizes by 30% is proposed to increase the city's density accordingly. However, this policy works best in conjunction with an increase in maximum dwelling units, which could be achieved through comprehensive upzoning. The accompanying increase in allowed density clears room for market forces to increase property values on individual lots, incentivizing higher-density development to maximize the potential of a given lot (Shortell, 2022). Indeed, this analysis has previously highlighted the connection between increased density and higher property values (Ottensmann, 1977) (Boudreaux, 2016). An increase in maximum dwelling units

and in conjunction with more compact residential neighborhoods is estimated to significantly increase urban density and multi-family housing availability (Chiumenti et al., 2014).

Minimum lot sizes are a barrier to increasing urban density because new construction takes up more land than is necessary to build a home and existing homes by statute occupy more space than they necessarily need. Large-lot zoning is responsible for increasing housing costs, which in turn excludes low-income people from lower density areas, as well as fueling urban sprawl, decreasing urban density (Boudreaux, 2016). A case study in Boston found that housing density was consistently below the level required to maximize land value and was a direct result of large minimum lot sizes (Glaeser & Ward, 2009). Relaxing the minimum lot size can increase the supply of multi-family units by between 28-58%, while also reducing rents by 5-6% (Chiumenti, 2021). Reducing minimum lot sizes may also increase land value, which would encourage denser development through economic incentives in order to maximize profits from existing parcels (Shortell, 2022). Interestingly, a 2017 study from Berkeley, California found that the single greatest determinant of increased accessory dwelling unit development was the reduction of minimum lot size restrictions, which speaks to the way in which these alternatives could hypothetically work in conjunction with each other (Chapple et al., 2017). This proposal suggests a 30% reduction in minimum lot size areas, a change based on a 2020 paper detailing minimum lot size reductions in Houston (Gray & Millsap, 2020). Smaller homes are another potential product of minimum lot size reduction. In addition to being more energy efficient given their smaller floor area, smaller homes rely on fewer carbon emissions to construct compared with larger homes (Goldstein et al, 2020) (Morales, 2018).

In Charlottesville, about 70% (2,278 acres) of residential land is zoned for single-family housing. Within this designation, properties zoned R-1 have a minimum lot size of 8,000 square feet, while R-1S parcels have a minimum lot size of 6,000 square feet. A 30% reduction in lot size for all residential neighborhoods as enacted in Texas, provides a solid foundation for densifying the Charlottesville community.

Policy Option 2: Eliminate Single-Family Zoning, Establishment of “Missing Middle” Housing

The recently adopted Future Land Use Map for Charlottesville creates new land use categories for properties in Charlottesville, increasing the minimum density requirements to accommodate denser development. This paves the way for the city to potentially eliminate single-family zoning altogether, allowing multi-family developments to be built in neighborhoods where new development that increased density was previously impossible. This type of reform allows for the influx of “missing middle” housing, referring to the duplexes and triplexes that are often missing from cities that can increase density without building up neighborhoods with massive apartment buildings. There is a broad consensus in the literature that denser urban areas require less energy consumption per person than municipalities with sprawling development (Guneralp et al., 2017) (EIA, 2017). Comparing high and low urban density, low density development generates 2.5 times the energy use of high-density

development per capita, and 1.5 times the energy use per unit of living space (Norman et al., 2016) By removing barriers to building more multi-family units, households which on average consume less energy on heating and marginally less on cooling than single-family households, the city could reduce the number of households living in inefficient single-family homes, thereby reducing energy costs.

Elimination of single-family zoning by allowing a minimum of 4 units of multifamily housing by-right on all residential parcels is not without precedent. In 2018, the Minneapolis city council voted to approve its new comprehensive plan. This plan proposed a radical change to its zoning code: a total elimination of single-family zoning, altering the maximum allowed density for 70% of the city's total land area. This allowed up to three family dwelling units on a property in its R-1 district, a change from its more conventional single-family zoning. In 2019, the Oregon state legislature passed HB 2001, which legalized the development of three or four-unit homes on residential land zoned for single-family housing in cities larger than 25,000 people. Portland followed up on this legislation with their 2021 Residential Infill Project, which implemented the reforms citywide. The city issued permits for 91 "missing middle" housing units over a six-month period following the reform, which amounted to 65% of the total units permitted during that period (Tracy, 2022). In Charlottesville, 70% of the total land area zoned as residential is occupied by single-family (R1) zoning. An increase in maximum dwellings matching that of Portland would on paper portend an increase in density from 5.7 units/acre to 12 units/acre, about a 100% increase in density. However, this level of densification is not realized in practice, as is discussed below in the findings. This proposal also recommends that a minimum of 10% of the subsequent redevelopment be guaranteed as affordable units reserved for low-income families through inclusionary zoning.

Policy Option 3: "Soft-Density" Infill Housing: By-Right Accessory Dwelling Units

Accessory Dwelling Units (ADUs) are small, independent residential units located on lots as single-family homes. ADUs can either be interior, like a converted basement apartment, or exterior, as in a converted or new standalone accessory structure. These dwelling units are a considered a type of infill housing. Infill housing is a type of housing strategy that does not require wholesale amendment to the zoning ordinance but allows increased density development to take place by inserting additional housing units into a pre-approved neighborhood. "Soft density" refers to infill housing that is less dense than a multi-unit apartment complex, but looks more like townhomes, duplexes, or ADUs.

ADUs promise to provide distributional equity, offering to change the composition of existing low-density neighborhoods (Van der Poorten & Miller, 2017). These units are also generally more affordable, rented at 25-50% below the market rate (Palmeri, 2014). A 2017 study from Berkeley, California found that the single greatest determinant of increased accessory dwelling unit development was the reduction of minimum lot size restrictions, which links this to the previous policy option on minimum lot sizes (Chapple et al., 2017). ADUs are shown to be affordable to build, about $250 per square foot, a

more affordable option that reflects the constrained size of these dwelling units (Chapple et al. 2017). In many places, there are owner-occupancy requirements, including in Charlottesville, that ensure that owners are reside in one of the units on the property.

Currently, ADUs are allowed in Charlottesville on a provisional basis, meaning the apartment requires review from the city in order for approval. These provisional use permits (PUPs) currently set height restrictions at 25 feet or below the highest point on the primary dwelling's roof, which allows for a denser form for the ADUs. The ordinance further requires that no more than 2 people may occupy an accessory apartment. Interior accessory dwelling units (see **Appendix F)**, such as basement apartments, have their own code and regulations restrict their gross floor area to 40% relative to that of the principal structure. The only exception to these PUPs is for land currently zoned R-3 under the zoning ordinance, which allows for an internal accessory apartment by-right. By-right accessory dwelling units across all residential zones, but particularly for single-family neighborhoods, would allow for "soft-density" to take root, which may be more politically palatable. By-right designations eliminates the need for things like special use permits, traffic analysis, or neighborhood approval to make changes to a property. The city would need to amend height, setback, and parking restrictions to accommodate increased demand for ADU permitting (Menard, 2016). Additionally, the city would need to establish a grant fund with the help of an RFP to help residents afford to build ADUs on their own property. This is particularly important to encourage low-income residents can access this opportunity for densification. Waiving the $100 application fee would further incentivize the development of ADUs to complement the by-right change.

Criteria

The following criteria were used to compare and evaluate the following policy options. These criteria were chosen based on their close relation with zoning and land use changes as strategies for reducing energy costs through densification.

1. **Cost**: Costs of implementing this proposal include consulting fees for the city, retraining of city planners and the digitizing of planning records. Additional costs to the city include an unknown amount of legal. However, considering each of the alternatives are funneled through the same zoning process, these costs do not differentiate the alternatives. Instead, for the purpose of this analysis, cost will include the amount of money spent by developers on building the additional housing units. Calculations can be found in **Appendix A**.

2. **Effectiveness:** Effectiveness measures the estimated percent reduction in Charlottesville's residential energy consumption. This will be achieved by taking stock of the projected number of housing units each alternative stands to add and extrapolating the city's subsequent increase in housing density. It is estimated that a 100% increase in urban density is correlated with a 35% reduction in citywide residential energy costs (Lee & Lee, 2014). From here, the estimated increases in density will be projected as a reduction of residential energy costs in Charlottesville over a 5-year period, a time period derived from data on policies taken at a 5-year

interval. Estimates of increased housing will be derived from case studies of similar interventions across the country. Calculations can be found in **Appendix A.**

3. **Equity**: Changes to zoning code will invariably affect the way development is structured in the city. Measuring how these changes minimize harm and maximize benefit to the most vulnerable populations in Charlottesville will be a key criterion. Equity criterion asks 3 questions: "Does the land use change give genuine access for low-income families to previously exclusive housing options?", "Are Charlottesville families affected equally by this land use change?", and "Do Charlottesville families benefit equally from the energy savings?" These questions I will assign an equity score of "high" for proposals that improve equity along all three of these dimensions. "Medium" scores apply to proposals that improve equity along two dimensions, and "low" scores are assigned to an alternative that only accounts for one of these questions or doesn't advance equity along any dimension. An evaluative matrix can be found in **Appendix B.**

4. **Political and Administrative Feasibility**: This criterion channels the likelihood of a proposal being implemented through the various administrative and political processes that zoning reform must traverse. Political feasibility will measure the Planning Commission's likelihood of recommending the proposed changes to the zoning ordinance and the City Council's likelihood of voting for approval based on prevailing political and economic interests in the city. For this purpose, an 8-point scale will be used to evaluate each alternative, the score of which is dependent upon the answers to questions in a matrix found in **Appendix C**. This matrix provides a framework for quantifying some of these considerations of political and administrative feasibility, providing a score of zero or one to each question based on a yes or no response.

Findings

I. Reduction of minimum lot sizes

Cost

The development costs associated with a reduction of minimum lot sizes relate to future densification of residential neighborhoods and the housing units required to achieve that increase in density. For this analysis, Chiumenti et al.'s lower estimation of changes in multi-family development, which ranged from increases of 28-58%, was used partially based on the incongruities between Boston, the study area, and Charlottesville with respect to urban character. This percentage was used to extrapolate growth of multi-family homes based on the current stock of multi-family housing units in Charlottesville, estimated to be around 11,068 units (*Charlottesville Virginia Housing*, n.d.). The increased quantity of housing units, marked at around 3,099 multi-family units, was combined with estimates of costs for building a multifamily unit, placed at $64,500-$86,000 per unit, to arrive at a cost of around $267 million (El Genaidi, 2021). This cost reflects the amount of money required to create new duplexes, triplexes, etc. in a number consistent with a notable increase in Charlottesville's density.

Effectiveness

As mentioned in the cost analysis, this reform will bring in around 3,099 new multi-family housing units. This would mark a 15% increase in Charlottesville's residential density. According to research connecting urban density and residential energy consumption, an estimate of a 5% reduction in municipal energy consumption can be extrapolated. The magnitude of this proposal reflects the indirect effects of land use on energy consumption, but this estimate could be higher presuming a more liberal estimate in multifamily housing units gained. Additionally, in alignment with research that shows single-family homes consume significantly more energy for heating and cooling than multifamily homes, this proposal can be viewed as an effort to replace these homes with more energy efficient types of housing, combatting sprawl while reducing the number of single-family homes.

Equity

Equity score: high

Minimum lot sizes have their origin in de jure racial segregation tactics and continue to exacerbate racial and economic segregation in urban spaces (Resseger, 2013). Requirements insisting lots be of a certain size historically made neighborhoods financially inaccessible by essentially placing a floor on residential parcel prices. High parcel prices, undergirded by neighborhoods with lots of base size, would in turn exclude lower income residents from accessing housing on those parcels, housing they may have been able to afford if the lot weren't so large. Reducing minimum lot sizes would, facilitated by market forces, allow parcels to shrink and reduce housing costs (Jaffe, 2020). Removing minimum lot requirements for accessory dwelling units would also encourage their proliferation, which would provide additional ways for homeowners to build financial equity. There are some concerns that if minimum lot sizes are not applied evenly across the city, they may propagate historical inequities relating to the history of racial redlining across the city. This would be problematic if lower-income neighborhoods were to have their minimum lot sizes reduced while wealthier neighborhoods remained unchanged. The equity matrix in **Appendix B** speaks to the success of this policy with respect to equity. This change would allow for a form of inclusionary housing, allowing low-income folks to live in cooler, more energy efficient neighborhoods with multiple housing types.

Feasibility

Feasibility score: 5

A September meeting of the City Council and the Planning Commission explored the idea of reducing lot sizes in Charlottesville, to which a strong majority of members expressed support for minimum lot size reduction. Two thirds of the Planning Commission expressed verbal interest for minimum lot size reductions including Commission Chair Lyle Solla-Yates. Again, the Planning Commission is responsible for bring the draft recommendation to City Council for approval. Four of five members of City Council including the Mayor and Vice-Mayor expressed verbal support for this policy as well, however Sena Magill vacated her seat on the council in January and was recently replaced by Leah Puryear (Tubbs, 2022). 3 of these 4 councilors are up for re-election in 2023 including Leah Puryear– meaning that some of their positions are

subject to change depending on their aspirations for re-election. Nevertheless, institutional support is critical for this process, and it seems plausible that this reform would pass under the current council. This is an issue that intersects heavily with affordable housing efforts in Charlottesville, and the issue of reducing minimum lot sizes in Charlottesville has received the endorsement of the Charlottesville Low-Income Housing Coalition (CLIHC), an organization that helped propose minimum lot size reductions as part of Charlottesville's Affordable Housing Plan. Given the strong indications of legislative support for his policy, a strong feasibility score of 5 out of a possible 8 – the scorecard can be found in **Appendix C.**

II. Eliminate Single-Family Zoning

Cost

In six months after Portland initiated its Residential Infill Project, 91 new multi-family units were issued permits across 26 lots, compared with 50 single-family home permits issued over that same period. Over a 5-year period in Charlottesville from 2017-2021, 951 new units were added in Charlottesville. Projecting the effects seen in Portland after adopting new multi-family residential zoning measures out over 5 years, Charlottesville might expect to see about 618 new multi-family units on 176 formerly R-1 zoned lots. 618 new units multiplied by the average construction cost for a multi-family unit in the US arrives at a cost estimate of about $53 million. This cost estimates the amount of money developers would spend building housing in Charlottesville over a 5-year period following the adoption of the zoning reform.

Effectiveness

Those 618 projected new units would replace the prior single-family units on whose lots they would be constructed, making for a total of 442 new units. Mapping on these housing changes seen in Portland to Charlottesville, the city can expect to see an increase in housing density of around 5%, which would inform only about a 1% reduction in household energy costs over the course of 5 years. However, this increase in density may be associated with the displacement of current residents due to the increase in value of land (Angotti & Morse, 2023). That being said, Angotti and Morse relate much of the correlation between displacement and upzoning to targeted rezoning of predominately low-income or African-American neighborhoods. The debate about the displacement effects of upzoning largely remains unsettled, and many scholars argue that increased density will provide more housing, addressing the overarching lack of housing that contributes to displacement (Glaeser & Gyourko, 2002) (Nolan, 2019).

Equity

Equity score: high

Zoning and land use policies in general have been at the heart of creating and propagating racial housing and economic inequities. In 1917, the *Buchanan v. Warley* Supreme Court case declared explicit racially biased zoning to be unconstitutional. However, racist policies continued to segregate our cities through a combination of redlining, racial covenants, minimum lot sizes, and single-family zoning. In the Minneapolis/St. Paul metro area, it was found that residential land zoned for multi-

family housing had a non-white population that exceeded that of a comparable neighborhood of single-family housing by 21 percentage points (Furth and Webster, 2022). This has cornered non-white residents into renting more and owning less, and renters lack the ability (and landlords the incentive) to make energy efficient provisions for their home. Efforts to undo this embodied history of racial segregation often point to reforming single-family zoning as a means to increase the supply of affordable housing in an effort to mitigate some of the deep wealth disparities borne from denial of homeownership to non-white Americans (*Charlottesville Affordable Housing Plan,* 2021). This proposal involves a rollback of single-family zoning everywhere in Charlottesville, applying this policy in an equitable distribution. Eliminating single-family zoning will also allow for low-income families to inhabit exclusive, more energy efficient neighborhoods. Alternative II receives 3 points and is evaluated as being a highly equitable solution.

Feasibility

Feasibility score: 5

This proposal has a strong presence in the new Comprehensive Plan. The 2021 Future Land Use Map (see **Appendix D)** designates much of the previously single-family residential area as "general residential", which leaves the door open for additional housing options within those neighborhoods. That the Comprehensive Plan and the draft zoning ordinance already lean heavily towards eliminating single-family zoning in Charlottesville altogether, it is fair to assess both the Planning Commission and City Council as supportive. The program would build on the existing planning department infrastructure and would not need its own department to operate, though it will require additional manpower in the form of new city planner hires considering the unprecedented nature of this reform. Single-family residential neighborhoods often have a litigious group of residents, and similar attempts to abolish the practice have been met with a slew of litigation attempting to undo the city's reforms. This adds a higher degree of uncertainty to the process as well as the imminent likelihood of the city incurring substantial costs from legal fees. Alternative II receives 6 points out of a possible 8 and is evaluated as an alternative with high feasibility.

III. By-Right Accessory Dwelling Unit Reform

Cost

As early as 1997, Portland, OR allowed ADUs by-right, meaning that a homeowner could build an ADU on their property, granted that it met the city's ADU guidelines (*Facilitating,* n.d.). In 2010, Portland waived its fees relating to increased use of property, clearing the way for increased ADU development. In the 5 years following this reform, 500 new ADU permits were issued (*Accessory Dwelling Units*, n.d.). Previously, in the years 1995-2009, only 370 ADU permits had been issued (See **Appendix E**). Chapple estimates that about 10% of all housing units permitted each year in Portland are ADUs as of 2015 (Chapple, 2017). In Charlottesville over the past 5 years, there were an average of 190 new housing units added per year. If the changes from Portland hold, Charlottesville would add an estimated 95 ADUs over the next 5 years. The estimated cost of an ADU is about $156,000 per unit, which sets the cost of this development at $14.8 million (Chapple, 2017).

Effectiveness

An influx of 95 ADUs to the Charlottesville housing pool would increase the city's housing density by about 1.6%, rendering a negligible 0.6% reduction in energy consumption over the course of 5 years.

Equity

Equity score: low

Accessory dwelling units have a more limited inclusionary effect compared with other alternatives. ADUs have a smaller, but still important, role in increasing housing accessibility in historically exclusionary neighborhoods (*Charlottesville Affordable Housing Plan*, 2021). ADUs are often rented to families in close proximity to the principal homeowner, i.e. family, friends, or acquaintances. This practice is not ubiquitous, but it does diminish the equity appeal of this proposal. In addition, there are substantial costs associated with building an ADU on a property, costs that could be prohibitive without subsidy. Finally, there is a risk of these units being built explicitly for short-term leasing (i.e. through AirBnB), where landlords see an opportunity to make more money by appealing to wealthy tourists. This risk can be attenuated by disqualifying these units as short-term rentals, but the chance is still there for these properties to eat away at the city's housing options and tax base. For these reasons, alternative III receives a 1 out of 3 possible points on the equity scorecard, relegating it to the "low" equity category.

Feasibility

Feasibility score: 5

Considering the city's current precedent for ADUs through the PUP process, there is a good opportunity for the city to build on this framework to improve the availability of ADUs. However, there was a lack of clear discussion of accessory dwelling units in the Comprehensive Plan and in the draft zoning ordinance, indicating that this topic is less ripe to be taken for a vote in City Council. However, a Planning Commission meeting in the fall showed broad support for sub-lot divisions, as well as interest in ADUs as a method for expanding homeownership. Considering this, it is likely that if a strong proposal were brought to the Planning Commission it would receive its blessing, though it seems less likely that City Council would approve a proposal related to by-right ADUs at this time. The proposal is unlikely to impose any sort of direct cost on Charlottesville residents, however the city may need to consider a grant fund to support the proliferation of this type of housing. Alternative III receives a 5 out of 8 on the feasibility scorecard (see **Appendix C),** which designates this option under "medium" feasibility.

Table 1: Outcome Matrix for Alternatives

Policy Proposal	Cost	Effectiveness	Equity	Feasibility
Measure	$ spent on housing construction	Reduction in city energy consumption	Scorecard	Scorecard
I	$267 million	5%	high	5
II	$53 million	1%	high	6
III	$14.8 million	0.6%	low	5

Recommendation

In light of this analysis, this paper recommends a dual strategy of alternatives I and II based on their relative effectiveness in lowering energy costs, their potential for equity and their mutual reinforcement of one another. In order to realize its full potential, alternative I requires a method of increasing maximum dwelling units per parcel to accompany the reduction in minimum lot size. Considering how far along in the zoning rewrite the city has now gotten, it is fair to say that the city will be raising this maximum for residences across the city to 3 units compared with the 4 this proposal offers. If required to choose between alternatives I and II, alternative II is the best option considering it is a more politically and administratively feasible option and it can function on its own without a need to eliminate single-family zoning throughout the city, a more politically fraught proposal (see **Table 1)**. Though the energy reduction potential is estimated to be higher for single-family zoning elimination, this is largely contingent upon an accompanying change to minimum lot sizes. Additionally, there are some risks that upzoning efforts like eliminating single family zoning may displace families, though this matter is as yet unsettled in the literature (Pough, 2018) (Angotti & Morse, 2023). Alternative III was not chosen because of its inability to densify the city substantially and the lack of equity in ADUs as a housing option. Low-income families may still be excluded from ADUs given they are generally leased to friends or family of the homeowner, and energy savings might only accrue within the wealthier population. However, alternative III provides a cheaper, more efficient way to densify the city filling in unused property with units that are often constructed from existing structures. This tradeoff means that more money will need to be spent to build new construction utilizing alternatives I and II.

Implementation

The development, implementation, and administration of any and all zoning changes falls to the Charlottesville Planning Department at the behest of the City Planning Commission and Charlottesville City Council. The elimination of single-family zoning and reduction of minimum lot sizes builds on the Comprehensive Plan and Future Land Use Map, adopted in 2021. These changes would be formally enshrined in the new zoning ordinance following approval from City Council and barring intervention from local or state judges. As previously mentioned, the zoning rewrite in Charlottesville is ongoing. The process has included a years long public engagement effort (Cville Plans Together), the adoption of a new Comprehensive Plan by the city council, and the ongoing drafting of a new zoning ordinance to carry out that plan. Community engagement efforts have included community open houses, joint work sessions with City Council and the Planning Commission, and Google forms for public comment. Open houses and work sessions are still underway for the draft zoning. These forms of community engagement are biased towards those with time and resources to attend hearings and submit feedback, which in this case favors wealthy homeowners in the city.

Considering the breadth and importance of zoning, touching many aspects of daily life for Charlottesville residents, there are many stakeholders to consider in this process. The diversity amongst these stakeholders covers a wide range of issues from housing to net zero energy providers. An initial list of stakeholders to engage includes:

- **Charlottesville Affordable Housing Fund (CAHF) Committee** – An apparatus of the city government, this group serves as the city's primary method of supporting, building and maintaining the city's affordable housing.
- **Charlottesville Low-Income Housing Coalition (CLIHC)** – this organization has been supportive of the progressive zoning rewrite; however, they would like to see even greater density allowed in single-family neighborhoods with greater provisions for affordable/inclusionary development.
- **Piedmont Environmental Council (PEC)** – PEC has been supportive of the draft zoning changes to date, and feel that infill and increased density will limit sprawl and conserve energy.
- **Cultivate Charlottesville Food Justice Network** – Cultivate Charlottesville has been vocal in the past about the importance of reforming Charlottesville's zoning code to reflect a more equitable city, and has in the past worked to collect resident feedback to provide to local officials on this matter in 2021.

Relatedly, the implementation process actors can be categorized into three helpful categories: managers, doers, and fixers (Weimer and Vining, 2017).

<u>Managers</u>
Managers of the process, often government actors assemble the policy apparatus charged with administrating the zoning change, directing doers how to implement the policy. The City Council and the City Planning Commission comprise this group. Together, these two bodies assemble the machine that facilitates this change at the

highest level of local government. Both are also able to coordinate across other Charlottesville government boards and commissions, like the Board of Architectural Review and the Charlottesville Redevelopment & Housing Authority (CRHA). The Board of Architectural Review is charged with reviewing applications for changes to design control district properties, as well as functioning as an advisor to City Council on matters related to design guidelines. The CRHA receives funding from the U.S. Department of Housing and Urban Development as well as from City grants to provide and maintain affordable housing in Charlottesville. CRHA manages a few programs, including their Housing Opportunities Program and their Down Payment & Closing Costs Assistance Program, which encourage homeownership by providing loans to families who do not qualify for mortgages and aid low-income families with down payments.

City Council is of particular importance. Though the body passed its progressive Comprehensive Plan in 2021, the council has since replaced Councilor Magill and three of the five face reelection this year. Monitoring the campaign process is vital to determine if councilors will bow to the pressures of wealthy homeowners in this election year as they look to vote on the zoning ordinance by the end of the year 2023. Nominally, each member of the current City Council, which will serve through December 31, 2023, is a member of the Democratic Party.

Doers

City planners have already created a draft zoning map to accompany the draft zoning ordinance. Charlottesville's Planning Department, which is separate from the Planning Commission, is responsible for implementing the zoning code once it has been passed. The Planning Department falls under the umbrella of Neighborhood Development Services, headed by James Freas. This group is broadly responsible for inspections, engineering, and technical services.

Fixers

C3 situates itself as a fixer, in the sense that it occupies the space where tensions arise over relevant policy issues locally. A key role of fixers is coalition building. Coalition building requires identifying receptive agencies or community partners to build a united front advocating for the proposed changes. Coalition building might also look like community engagement, with a string of local organizations combining their resources and networks to reach community members in a way that the city government cannot.

Opposition Groups

Zoning changes that specify increased density or use intensity often receive backlash from homeowners, who are often wealthier, whiter, and feel their property investments are threatened. While this group is often not explicitly organized in a coordinated manner, they don't have to be since they are well-resourced enough to show up to public hearings for free. However, in response to the adoption of the Comprehensive Plan in 2021, the anti-reform organization Citizens for Responsible Planning was formed as a group of concerned citizens who feel aggrieved by the zoning process and wish to protect their neighborhoods from upzoning. Litigation is often a tactic used by opponents to stall or reverse proposed zoning amendments, and homeowners are often a litigious bunch. In December 2021, a group of concerned homeowners sued the

city of Charlottesville in an effort to overturn the Comprehensive Plan adopted by City Council, arguing that the city did not follow state law by failing to expand transportation infrastructure to accompany the increased density (Tubbs, 2022).

Implementation Considerations

Cville Plans Together hosts an email address for the purpose of collecting feedback for the Planning Commission on the current revision of the draft zoning ordinance. The commission will take the feedback sent to this address and code the responses into a qualitative analysis piece before its final revisions in the summer of 2023. C3 works in its capacity as a local non-profit to engage the public on a number of energy related topics. This work includes a blog that promotes local opportunities to engage with public processes, including the current zoning rewrite process. C3 also hosts volunteer events to advocate for and disseminate information related to local reductions of carbon emissions, promoting civic engagement in climate action. This extends to a letter campaign that promotes residents voicing their desire for climate action in the form of a letter sent to local officials. This campaign could be leveraged to send letters via email to the planning commission from residents expressing their interest in smart-growth, climate sensitive zoning reform. Successful campaigns from non-profits in cities that have adopted progressive zoning reforms, like Minneapolis, utilized pre-filled but customizable comments that can be sent directly from the organization website to local officials (*Support zoning*, 2023). For Charlottesville's zoning rewrite, it is recommended that these emails be sent directly to the planning commission. The Planning Department will need to further identify heigh, parking, and setback changes accommodate the changes in minimum lot sizes and residential zoning before the Planning Commission can make its final recommendation.

Following period of community engagement, the city will adopt the zoning and minimum lot changes into the draft zoning ordinance. Once the zoning ordinance is adopted, the process is open to imminent litigation from citizens and businesses that oppose the Council's move. At this point, the fate of the process rests in the hands of either local or state level judges who hold the power to rule for amendment or wholesale abandonment of the entire planning imitative.

Conclusion

Energy costs, housing stock, and their relationship to land use regulations form a complicated knot. It will not necessarily be as straightforward as upzoning neighborhoods thereby densifying the city and reducing residential energy costs. Complex forces of displacement and economic incentive will take time to equilibrate. However, reducing minimum lots sizes in conjunction with increasing the maximum allowed dwelling units across neighborhoods in Charlottesville will work effectively towards that end. Ensuring economic integration of previously exclusive neighborhoods will provide residents with access to more abundant and more energy efficient housing options. These options in tandem will be key to bringing our zoning code in line with the city's stated goals of climate and racial justice.

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Appendix A: Cost Estimates for Policy Alternatives

Alternative I
Cost
21,285 housing units – 20,334 housing units = 951 units of housing added from 2017 to 2021.

Portland gained 91 multifamily units across 26 lots during a six-month period after zoning reform. A total of 50 single-family home permits were allotted during this time, with multi-family units accounting for 65% of the new units added. Assuming housing continues to grow at the same rate in Charlottesville in the next five years as the previous five:

0.65*951 = 618 units

In Portland, 91 units were spread across 26 lots, a ratio of 3.5 units per lot. Applying this ratio to the 618 units added:

618 units/3.5 units per lot = 176 lots

Cost = price per unit*# of units = $86,000*618 = **$53 million**

Effectiveness
618 new units added in Charlottesville increases density (assuming the city does annex land)
Charlottesville area = 6,573 acres
21,285 units + 618 units = 21,727 units
21,727units/6,573 acres = 3.3units/acre
Calculate percentage change from status quo
[3.3units/acre – (21,285 units/6,573 acres)]/ (21,285 units/6,573 acres) =
(3.3-3.2)/3.2*100 = 3% increase in density

From Lee & Lee, we assume a 100% increase in density is associated with a 35% reduction in energy consumption. Applying this to the increased density:

100/3= 33, so 35/33 = **~1% reduction in energy consumption**

Alternative II
Cost
From Chiumenti et al.: Taking the conservative end of the 28-58% increase in multifamily units.

52% of units in Charlottesville are multi-family, which is equivalent to 11,068 units

A 28% increase in multifamily units = 11,068*0.28 = 3099 units

Cost = price per unit*# of units = $86,000*3099 = **$267 million**

Effectiveness
3099 new multifamily units added increases Charlottesville's density:
21,285 units + 3099 units = 24,384 units
24,384 units/6573 acres = 3.7 units/acre
(3.7-3.2)/3.2 * 100 = 16% increase in density

From Lee & Lee, we assume a 100% increase in density is associated with a 35% reduction in energy consumption. Applying this to the increased density:

100/16= 6.25, so 35/6.25 = **~5% reduction in energy consumption**

Alternative III
Cost
In 2015, 5 years after 2010 ADU reform in Portland, Chapple et al. estimates that about 10% of all new units every year are ADUs.

21,285 housing units – 20,334 housing units = 951 units of housing added from 2017 to 2021 or 951 units/5 years = 190 units/year

190*0.10 = 19 new ADUs per year, over 5 years: 19*5 = 95 new ADU units

Chapple estimates the cost to build an ADU to be $156,000

Cost = price per unit*# of units = $156,000*95 = **$14.8 million**

Effectiveness
95 new ADU units increases housing from 21,285 units to 21,380 units

21,380 units/ 6,573 acres = 3.25 units/acre

(3.25 units/acre – 3.2 units/acre)/3.2 units/acre * 100 = 1.6% increase in density

From Lee & Lee, we assume a 100% increase in density is associated with a 35% reduction in energy consumption. Applying this to the increased density:

100/1.6 = 62.5, 35/62.5 = **0.56% reduction in energy consumption**

Appendix B: **Feasibility Matrices**

Minimum Lot Size Reduction: Feasibility Matrix	
Question	Point Value
Has the proposal been thoroughly addressed in the new Comprehensive plan?	Yes (1) **No (0)**
Is the Planning Commission likely to recommend it to City Council?	**Yes (1)** No (0)
Is City Council likely to adopt the proposal?	**Yes (1)** No (0)
Does this proposal require a new department or program, or can it involve the expansion of a pre-existing program?	Yes (0) **No (1)**
Does this program require substantial new department expenditure to be implemented?	Yes (0) **No (1)**
Does this program have precedent in Charlottesville already?	Yes (1) **No (0)**
Is the program likely to inflict direct and immediate financial costs on residents?	Yes (0) **No (1)**
Is there precedent for state or local level opposition or court challenges?	**Yes (0)** No (1)
Feasibility Score: 5	

Single-Family Zoning Reform: Feasibility Matrix	
Question	Point Value
Has the proposal been thoroughly addressed in the new Comprehensive plan?	**Yes (1)** No (0)
Is the Planning Commission likely to recommend it to City Council?	**Yes (1)** No (0)
Is City Council likely to adopt the proposal?	**Yes (1)** No (0)
Does this proposal require a new department or program, or can it involve the expansion of a pre-existing program?	Yes (0) **No (1)**
Does this program require substantial new department expenditure to be implemented?	**Yes (0)** No (1)
Does this program have precedent in Charlottesville ordinance already?	Yes (1) **No (0)**
Is the program likely to inflict direct and immediate financial costs on residents?	Yes (0) **No (1)**
Is there precedent for state or local level opposition or court challenges?	**Yes (0)** No (1)
Feasibility Score: 6	

By-Right Accessory Dwelling Unit Reform: Feasibility Matrix	
Question	Point Value
Has the proposal been thoroughly addressed in the new Comprehensive plan?	**Yes (1)** No (0)
Is the Planning Commission likely to recommend it to City Council?	**Yes (1)** No (0)
Is City Council likely to adopt the proposal?	Yes (1) **No (0)**
Does this proposal require a new department or program, or can it involve the expansion of a pre-existing program?	Yes (0) **No (1)**
Does this program require substantial new department expenditure to be implemented?	**Yes (0)** No (1)
Does this program have precedent in Charlottesville ordinance already?	**Yes (1)** No (0)
Is the program likely to inflict direct and immediate financial costs on residents?	Yes (0) **No (1)**
Is there precedent for state or local level opposition or court challenges?	**Yes (0)** No (1)
Feasibility Score: 5	

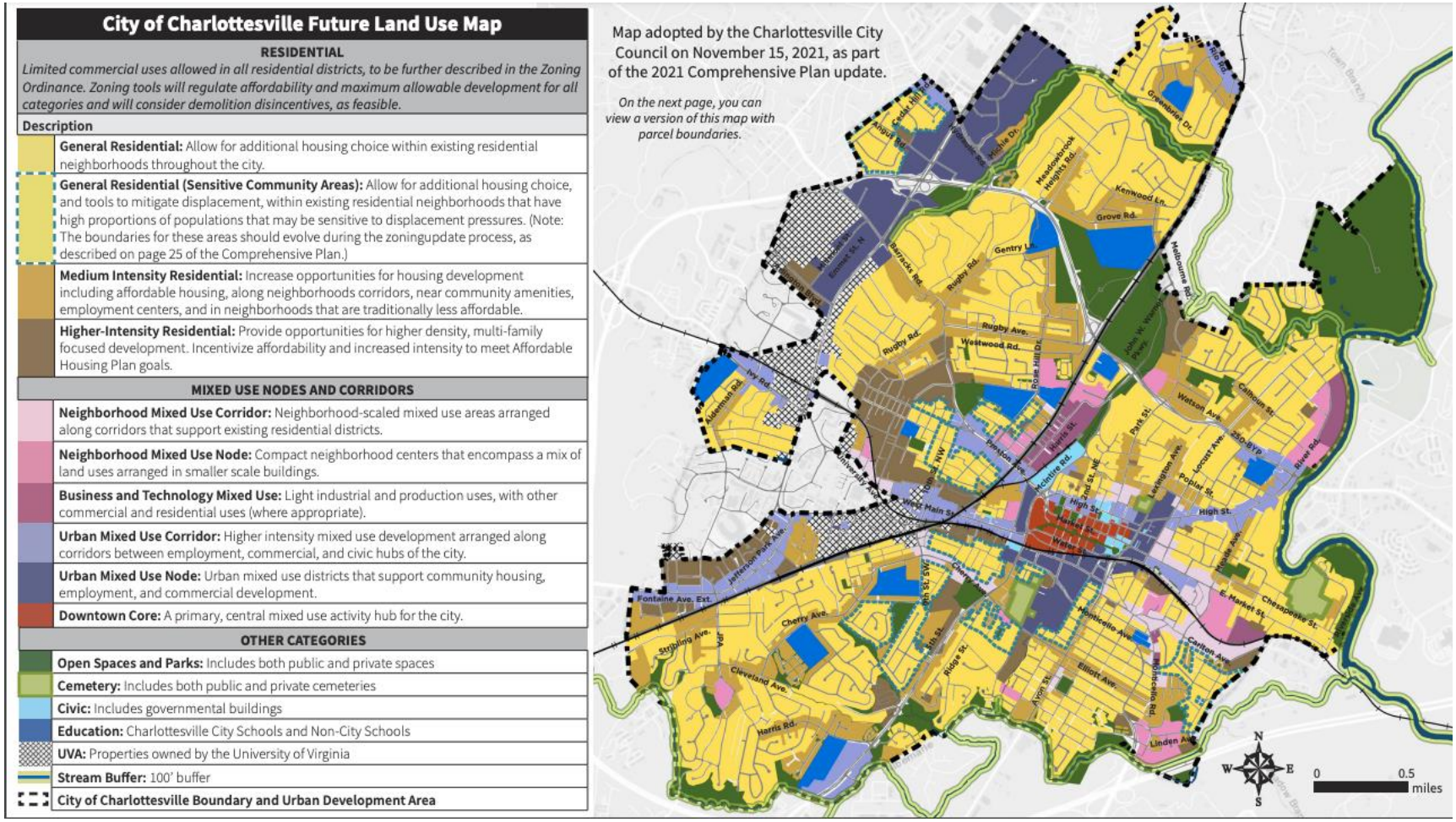
Appendix C: Equity Matrices

Minimum Lot Size Reduction: Equity Matrix	
Question	Point Value
Does the land use change give genuine access for low-income families to previously exclusive housing options?	**Yes (1)** No (0)
Are Charlottesville families affected equally by this land use change?	**Yes (1)** No (0)
Do Charlottesville families benefit equally from the energy savings?	**Yes (1)** No (0)
Equity score: 3	

Single-Family Zoning Reform: Equity Matrix	
Question	Point Value
Does the land use change give genuine access for low-income families to previously exclusive housing options?	**Yes (1)** No (0)
Are Charlottesville families affected equally by this land use change?	**Yes (1)** No (0)
Do Charlottesville families benefit equally from the energy savings?	**Yes (1)** No (0)
Equity score: 3	

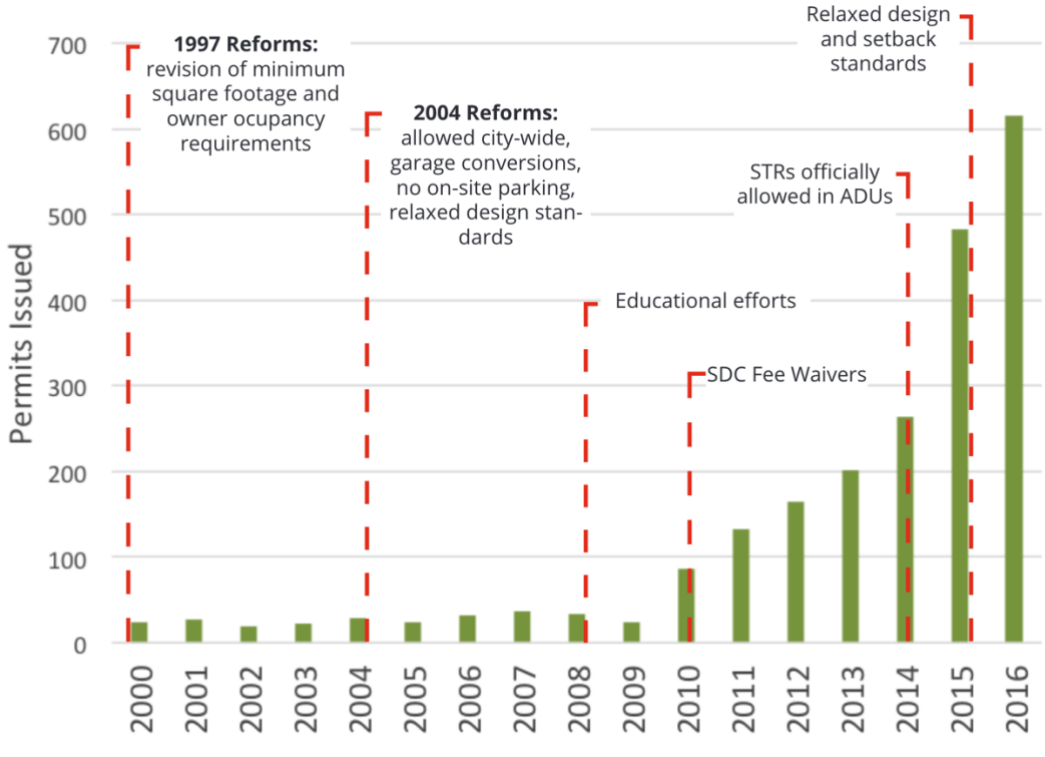
By-Right Accessory Dwelling Unit Reform: Equity Matrix	
Question	Point Value
Does the land use change give genuine access for low-income families to previously exclusive housing options?	Yes (1) **No (0)**
Are Charlottesville families affected equally by this land use change?	**Yes (1)** No (0)
Do Charlottesville families benefit equally from the energy savings?	Yes (1) **No (0)**
Equity score: 1	

Appendix D: Charlottesville 2021 Future Land Use Map



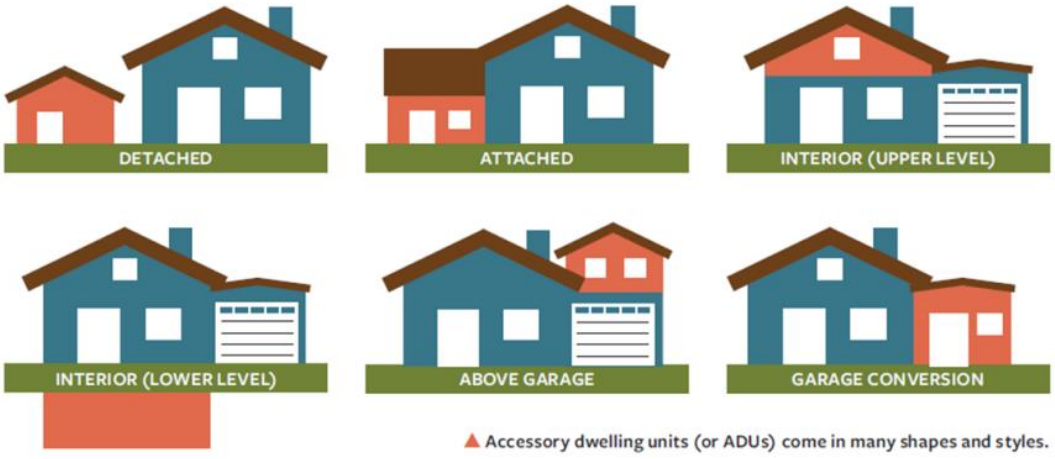
Source: *Charlottesville Comprehensive Plan.* 15 November, 2021. Retrieved from https://cvilleplanstogether.com/citywide-comprehensive-plan/

Appendix E: Increase in ADU development after reform in Portland, OR



Source: Chapple, K. (2017, May 24). *Jumpstarting the market for accessory dwelling units*. The Berkeley Blog. https://blogs.berkeley.edu/2017/05/23/jumpstarting-the-market-for-accessory-dwelling-units/

Appendix F: Diagram of various ADU typologies



Source: Accessory Dwelling Units (ADU). (2021, May 6). City of Redlands. https://www.cityofredlands.org/post/accessory-dwelling-units-adu

Appendix G: Other Considerations

Per the client's request, I have included a summary of additional ideas relating to the reduction of energy costs in this appendix.

Energy Cost Reduction Strategies

An alternative approach to tackling energy burdens in Charlottesville involves policies that expand energy efficiency in low-income housing and provide incentives for landlords to improve energy efficiency in their rental properties. The Low-Income Housing Energy Assistance Program (LIHEAP) is a federal social services program designed to help low-income households pay their energy bills but has been largely ineffective and inconsistent in its application. LIHEAP mostly pays for weatherization, which mainly entails heat loss reduction in winter, though only about half of the households in need in the United States are served by LIHEAP (Hernandez & Bird, 2010). The Weatherization Assistance Program (WAP), another energy savings policy from the 1970s, also helps households by increasing energy efficiency, saving households on average $372 on energy costs per year (*Weatherization Assistance Program*, 2022). Another large gap in policy involves the principal-agent problem which leaves private landlords uninterested in the economic benefits of investing in energy efficiency, a cost borne by the tenant. Landlords do not occupy their rental properties, meaning that there is often little incentive for them to make properties more energy efficient Considering an city housing report from 2016 that indicates that extremely-low income households comprised the smallest share of homeowners at 10%, it is safe to say that this is an issue that implicates our energy burden neighbors in Charlottesville (*Comprehensive*, 2016). Addressing this incoherence through housing policy offers another potential alternative to reducing energy burdens in Charlottesville.

One study of note analyzes housing units using US Census, American Community Survey (ACS) and Residential Energy Consumption (RECS) data to determine the effect of an expansion of compact housing on greenhouse gas emissions in Blacksburg, Virginia. The study developed future alternatives for development in the city based on the comprehensive plan, with a target projection date of 2050. The moderate scenario results in an estimated 25.3% reduction in residential energy use compared with the baseline, while a more aggressive scenario (where ¾ of new units in Blacksburg would be multi-family) results in a 35.5% reduction (Pitt, 2013). Many of the calculations here are speculative and based on extrapolations from US Department of Energy data from the 2005 RECS, which makes sense considering the hypothetical nature of this analysis. However, questions remain over how accurate these numbers would be in practice. Additionally, the RECS data is not fine grain enough to account for a lot of local variation and there are some problems with its statistical viability considering it is drawn from a non-random sample. The study appears to be quite generalizable considering the similarities in demographics and climate between Blacksburg and Charlottesville. Nevertheless, this study is grounded in good research that indicates that there is a relationship between urban density and reductions in residential energy usage and builds on the body of research. Specifically, it elaborates on Rong and Ewing's theory of residential energy use varying with urban density through the vectors of housing stock,

sprawl, and transportation (Ewing and Rong, 2008). If nothing else, this paper has provided a blueprint for estimating potential energy and greenhouse gas savings from denser urban construction and will likely form the basis for my comparative analysis of cities in the South.

The Ewing and Rong study used OLS regression to analyze individual household characteristics in their prominent 2008 study, including number of people per household, income, race, housing type, age, and size in their model. Controlling for these covariates, the model predicts a 54% reduction in heating energy consumption and a 26% reduction in cooling energy consumption, as previously mentioned. In addition, the study finds that a household in a more compact urban community is expected to consume 20% less energy annually. Some limitations apply to these findings considering they were aggregated across numerous municipalities with different zoning and building codes which may confound the relationship between sprawl and energy use, though the model seems to hold water with respect to housing type/form. In addition, the paper provides suggestions about how density might be boosted using zoning density caps, reducing minimum lot sizes, and offering density bonuses. Another study corroborates many of these findings using a model testing the causal relationship between urban spatiality and household CO2 emissions, which is a proxy for household energy consumption (Lee & Lee, 2014). The model uses population density as an estimate of compact urban form and estimates that a doubling of urban density is highly correlated with a 48% reduction in transportation energy use and a 35% reduction in residential energy consumption (Lee & Lee, 2014). It is unclear if there is enough information to determine a causal effect, however the models showed a strong correlation between these elements.

Landlords miss out on the savings the tenant receives for improved energy efficiency in their rental property. Sometimes tenants themselves forgo applying for relief from LIHEAP because, given their status as renters, improved efficiency will benefit the tenants that succeed them more so than their own household (Hernandez & Bird, 2010). One solution to these problems is to mandate higher energy efficiency for low-income rental housing, which has the potential to drastically increase the energy efficiency of the target units, though may reduce incentives for landlords to lease low-income housing units in the first place (Bird & Hernandez, 2012). There is also a chance these costs will be passed on to the renter in the form of increased rent. Perhaps a better idea, however, is on-bill financing programs, which provides a loan to a tenant which is then paid back through a utility company. The loan funds energy efficiency improvements, the cost of which is added to the utility bill but is then made up for by energy savings (Johnson et al., 2012). A pilot program in Kansas saw 14% of participants in a similar program were from rental properties (Mundaca & Kloke, 2018).

Exemption of net zero enabling technologies from setback requirements strategy

Zoning codes are responsible for more than simply controlling density and intensity of use. Zoning ordinances carry specific provisions for how tall and how far from property lines structures on a parcel can be. Charlottesville's current zoning code sets exemptions for solar systems from both height and setback requirements as stipulated

in Section 34-1108 of the zoning ordinance. Currently, the city of Charlottesville has comparatively generous provisions for height exemptions for solar panels, allowing solar systems to exceed 5 feet above the maximum roof height designated for a property, and can reach as tall as 15 feet high on any other structure on the property. However, there is less generosity with respect to yard setback exemptions for solar systems. These cannot exist at all in required yards and must be no closer than 5 feet from the property line.

Setbacks are important parameters governing equity in the city. In densely populated areas with smaller lot sizes, which are often low-income neighborhoods consisting primarily of people of color in Charlottesville, setback requirements are more burdensome and hamper resident's ability to install solar systems if they so desire (Sanches, 2021). Allowing solar panels to exist closer to the borders of a parcel, or removing those requirements altogether would allow low-income residents and renters to benefit from resilient and cost-saving technologies. However, the average cost of a solar system in Charlottesville is $14,950 without subsidy, meaning that for a low-income family, the price is likely too prohibitive to consider. That price effectively falls to $11,159 with the 30% federal tax credit on average. While setback reform doesn't reduce costs of solar installations, it does remove barriers to installing them by allowing more properties of varying size and composition to accommodate them.

Graduated Density Zoning

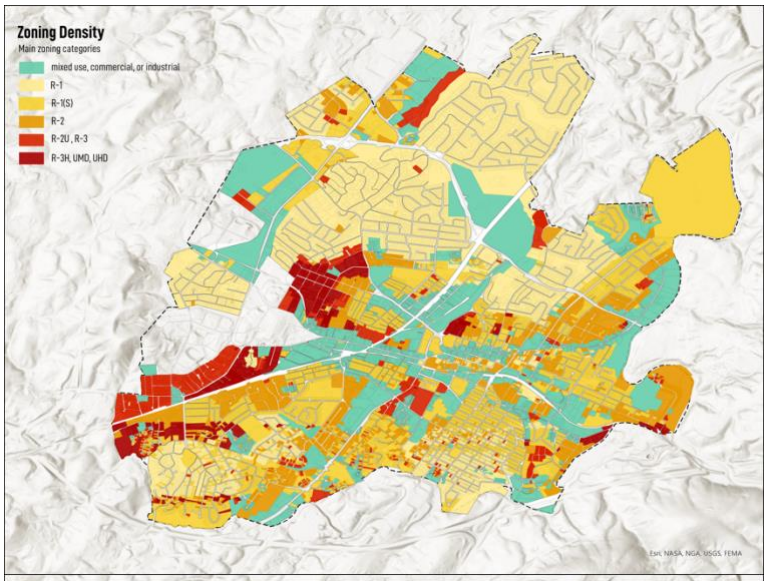
Graduated density zoning is a method of voluntary land assembly that takes some of the challenges of infill housing development, which primarily includes the difficulty in finding large parcels of land or contiguous parcels of land to redevelop and applies market forces to encourage voluntary redevelopment. This process allows for higher density development on larger parcels, the type of density scaling with the size of the parcel. This strategy encourages efficient use of available space in cities, promoting density, while also circumventing many of the challenges around land assembly and traditional infill housing. Graduated density is an attempt to smooth over these challenges and is touted to increase density and housing affordability in exclusionary neighborhoods in a way that is more politically and socially palatable than eminent domain (Shoup, 2008) (Shoup, 2018).

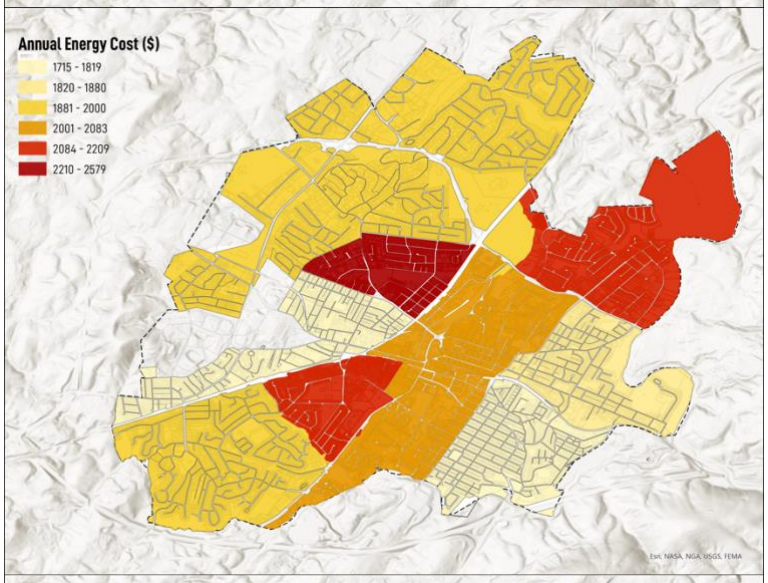
A graduated density zoning case study from Simi Valley, a suburb of Los Angeles, illustrates this alternative's potential effectiveness at promoting density. Devised for Kadota Fig, a large-lot residential neighborhood, which was largely rural in character, the city implemented graduated density zoning as a means of more efficiently densifying the area. The graduated density ordinance allowed up to a doubling of density on parcels 13 acres or larger. This encouraged land assembly – by 2000, 4 years after the city adopted the specific plan, a developer had built 200 homes on a site which was previously only occupied by 8 homes. In other words, the graduated density provisions had allowed the site to turn a doubling in density from the code into a neighborhood 20 times denser through land assembly (Shoup, 2008). In a wealthy, single-family neighborhood, this would be an expeditious way of making effective use

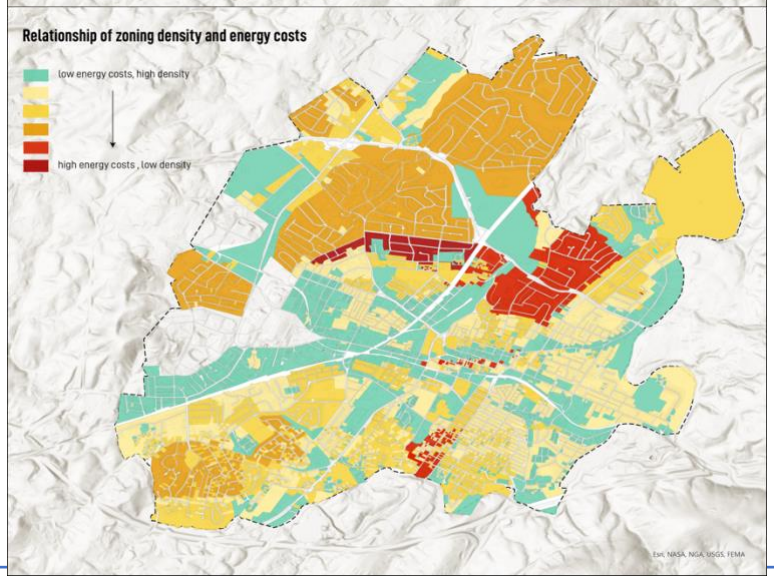
of parcel sizes as well as introducing higher-density housing to previously exclusive neighborhoods.

Graduated density zoning is a specific type of density bonus that depends, not on developers paying into a fund or stipulating a set number of units as affordable, but on the developer's ability to assemble land. This zoning provision would allow for higher density development on larger lots, incentivizing a type of infill housing that relies on lot consolidation. In Glendale, CA, their density bonus law mandates density bonuses in certain residential zoning neighborhoods, allowing for a 25% increase in density on lots greater than 90 feet wide. Because of the potential issues relating to gentrification, this strategy may serve better as a pilot program where a neighborhood is selected specifically for this purpose. Not every neighborhood is appropriate for land assembly, and low-income neighborhoods may see displacement if land assembly begins to outstrip efforts to keep housing affordable. Ideally, this strategy would work best as a mixed-use neighborhood or for a residential neighborhood located along a main transportation corridor.

Appendix H: Zoning Density + Energy Cost Maps







Appendix I: Lot Size + Racial Demographic Map