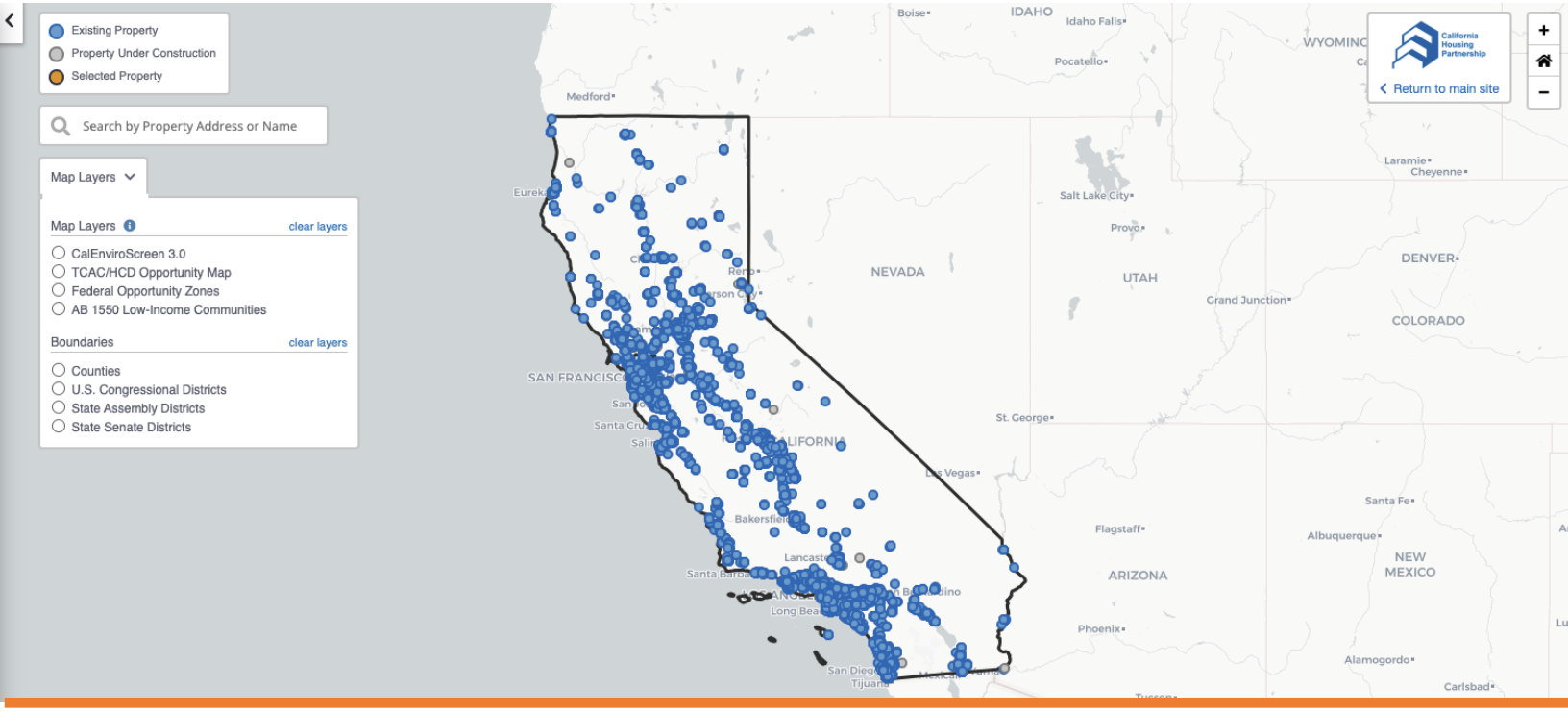

METHODOLOGY DOCUMENTATION

Quantifying Social and Economic Benefits of Affordable Rental Housing in California

October 2021

California Housing Partnership
California's Experts on Affordable Housing Finance, Advocacy & Policy

https://chpc.net/datatools/affordablehomes/

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INTRODUCTION

Purpose of the Affordable Housing Map and Benefits Calculator

The Affordable Housing Map and Benefits Calculator uses the California Housing Partnership's Preservation Database—an inventory of federally and state-subsidized affordable rental properties, many of which also receive local subsidies—and leverages academic research on the social and economic benefits of affordable housing to provide an interactive, web-based map that illustrates the following features of affordable rental housing throughout the state:

- Information about each property, who it serves in terms of population and income, the way it is financed, and how many years it has operated.
- The social, economic, and environmental benefits of each affordable property.
- Reports on the aggregate characteristics and benefits of affordable housing in particular counties, cities, and legislative districts.

Because the public agencies that fund affordable housing manage their program data independently, policymakers, housing advocates, and elected officials lack easy access to data and visual tools that provide comprehensive pictures of affordable housing and its benefits in their communities. The California Housing Partnership hopes the Affordable Housing Map and Benefits Calculator's data and evidence-based estimates of affordable housing's social, economic, and environmental impacts will help address this need. We also hope to improve the tool over time as new data and research becomes available and based on feedback from key stakeholders.

About the California Housing Partnership

The California Housing Partnership creates and preserves affordable and sustainable homes for Californians with low incomes by providing expert financial and policy solutions to nonprofit and public partners. Since 1988, the Partnership's on-the-ground technical assistance, applied research, and legislative leadership has leveraged approximately $25 billion in private and public financing to preserve and create more than 75,000 affordable homes.

Please visit our website at www.chpc.net.

METHODOLOGY

The Affordable Housing Map and Benefits Calculator is an interactive map of federally and state-subsidized affordable rental properties in California, many of which also receive local subsidies, that quantifies the social, economic, and environmental benefits for individuals and families living in affordable housing as well as those accruing to surrounding communities. The tool uses the latest available academic studies on the impacts of affordable housing to translate property characteristics—such as number of units, length of affordability restrictions, and location of the property—into quantifiable estimates of social and economic impact, including:

Household Rent Savings from Affordable Housing quantifies the savings—or boost in discretionary income—low-income households experience when residing in rent-restricted affordable housing.

Lifetime Earnings Boost for Children estimates long-term earnings increases for children who live in affordable housing during childhood, as well as additional income boosts if that housing is located in a neighborhood whose characteristics have been shown by research to support childhood development and economic mobility.

Medical Cost Savings from Severe Obesity and Diabetes Reductions estimates the health benefits and medical cost savings from living in low-poverty neighborhoods for low-income families.

Pediatric Health Savings from Living in a Lower Poverty Community estimates the health benefits to children and the associated medical cost savings from living in low-poverty neighborhoods for children from families with low incomes.

Medical Cost Savings from Reduction in Pediatric Asthma ED Visits estimates the reduction in asthma-related emergency department use and its associated cost savings for children living in affordable housing.

Greenhouse Gas Emission Reductions estimates the impact of locating affordable homes near transit and job centers on greenhouse gas emissions from automobiles.

Community Economic Benefits estimates the economic activity generated by the construction and occupation of multifamily homes including jobs, income, and taxes.

The following methodology documents the body of research motivating each benefit, the process by which benefits are calculated, and the data sources we rely upon.

Inventory of Affordable Rental Housing

The universe of affordable rental housing captured in the tool is from the California Housing Partnership's Preservation Database, an inventory of federally and state-subsidized affordable rental properties, many of which also receive local subsidies. The Preservation Database tracks property-level data—such as property name, location, populations served, number of units, bedroom composition, rental assistance contract effective and expiration dates—and assesses whether the property is at risk of converting to market-rate. It includes properties financed or assisted by the U.S. Department of Housing and Urban Development (HUD), the U.S. Department of Agriculture (USDA), the California Housing Finance Agency (CalHFA), the California Department of Housing and Community Development (HCD), and the Low-Income Housing Tax Credit (LIHTC) program administered by the California Tax Credit Allocation Committee (TCAC). The California Housing Partnership is in the process of expanding the database to include locally created affordable housing.

Program Descriptions

Below is a description of each program and financing mechanism captured in the Affordable Housing Map and Benefits Calculator, as well as the respective administering agency.

U.S. Department of Housing and Urban Development Programs

From the 1960s to the 1980s, the U.S. Department of Housing and Urban Development (HUD) provided multifamily developers with subsidized mortgages, Section 8 project-based rental assistance (PBRA) contracts, and other financing programs to help finance the construction, rehabilitation or acquisition of affordable housing developments throughout the United States. The Affordable Housing Map and Benefits Calculator includes affordable rental properties receiving federal subsidies from the following HUD programs and financing mechanisms:

- HUD Project-Based Rental Assistance
    - Project-Based Section 8 (previously known as the Section 8 New Construction and Substantial Rehabilitation Program)
    - Project Rental Assistance Contract (PRAC/202 and PRAC/811)
- HUD Preservation programs, including Section 202 Direct Loans
- HUD Insurance Programs

- Section 221(d)(3) Below Market Interest Rate (BMIR)
- Section 236
- Sections 231, 241(a), and 542(c): Mortgage insurance for rental housing for the elderly

The California Housing Partnership receives quarterly updates from the Regional HUD office for the approximately 1,800 HUD-subsidized properties in California.

U.S. Department of Agriculture (USDA) Rural Development Housing

The USDA Rural Development Housing and Community Facilities Programs Office (RD) has issued subsidized mortgage loans, grants and rental assistance to developers of multifamily rural rental housing since the 1960s. The Affordable Housing Map and Benefits Calculator includes affordable rental properties receiving subsidies from the following USDA programs:

- Section 515 Rural Rental Housing Loan program
- Section 514 Farm Labor Housing (FLH) program
- Section 521 Rental Assistance program

Data on active USDA Section 514, 514, and 521 properties in California is updated annually.

California Department of Housing and Community Development (HCD) Programs

The California Department of Housing and Community Development (HCD) is a state-level government agency that oversees a number of programs and allocates loans and grants to preserve and expand affordable housing opportunities and promote strong communities throughout California. The Affordable Housing Map and Benefits Calculator includes affordable rental properties receiving subsidies from the following HCD programs:

- Affordable Housing and Sustainable Communities (AHSC) program
- California Housing Rehabilitation Program (CHRP)
- Homeless Youth Multifamily Housing Program (HYMHP)
- Multifamily Housing Program (MHP)
- Rental Housing Construction Program (RHCP; RHCP-O)
- Special User Housing Rehabilitation Program (SUHRP)
- Supportive Housing Multifamily Program (SHMHP)

- Transit Oriented Development Housing (TOD) program
- Veterans Housing and Homelessness Prevention (VHHP) program

The above list does not represent the full universe of HCD affordable housing programs. Over time, the Partnership plans to expand its coverage of HCD programs to be fully comprehensive.

The California Housing Partnership receives annual data updates from HCD on developments that have received funding and completed the underwriting process. Therefore, full funding data on HCD programs often lags TCAC-provided data, which is made available to the Partnership when tax credit awards are made.

California Housing Finance Agency (CalHFA) Programs

The California Housing Financing Agency (CalHFA) is California's affordable housing bank that provides financing and programs that support affordable housing opportunities for low to moderate-income households. The Affordable Housing Map and Benefits Calculator includes affordable rental properties receiving subsidies from the following CalHFA programs and financing products:

- Conduit Issuer Program
- Permanent Loan Program
- Mental Health Program
- Federal Financing Bank (FFB) program

The California Housing Partnership receives annual data updates from CalHFA on developments that have received funding and completed the underwriting process. Therefore, full funding data on CalHFA programs often lags TCAC-provided data, which is made available to the Partnership when tax credit awards are made.

Low-Income Housing Tax Credit (LIHTC) Program

The Low-Income Housing Tax Credit (LIHTC) program—created in 1986 and made permanent in 1993–is the largest source of Federal funding for the construction and rehabilitation of low-income affordable rental housing. These credits are designed to encourage private investment in affordable housing by providing tax incentives for a ten-year period. Since its creation as part of

the Tax Reform Act of 1986, the program has helped create and rehabilitate over three million affordable rental homes across the country.[1]

There are two types of Federal LIHTCs: competitive 9% credits—which are allocated annually by the IRS on a per capita basis to each state—and non-competitive 4% credits. While the 4% credit offers a subsidy of less than half the value of the 9% credits, it is a virtually uncapped and non-competitive resource because developers obtain it through an allocation of private activity tax-exempt mortgage revenue bonds, which have historically not been competitive.[2]

In addition to Federal LIHTCs, California also has a State LIHTC, which was authorized in 1987 to complement the Federal tax credit program.

The Affordable Housing Map and Benefits Calculator includes affordable rental properties receiving Federal and/or State LIHTCs. The California Housing Partnership receives semi-annual data updates from the California Tax Credit Allocation Committee.

Local Programs

The California Housing Partnership is currently in the process of expanding the Preservation Database and the Affordable Housing Map and Benefits Calculator to include affordable homes with rent restrictions governed by local programs, including land use ordinances, grants, and loans from local governments. At this time, however, only affordable rental properties financed or assisted by the U.S. Department of Housing and Urban Development (HUD), the U.S. Department of Agriculture (USDA), the California Housing Finance Agency (CalHFA), the California Department of Housing and Community Development (HCD), and the LIHTC program are included.

Data Integration, Cleaning, Deduplication, and Updating

In leveraging the Preservation Database, the tool offers users a comprehensive estimate of the inventory of federally and state-subsidized affordable rental properties based on available data from the administering agency. The accuracy, timeliness, and completeness of each data source has varied over time and by program. To ensure that property-level data is as precise as possible, the California Housing Partnership engages in a rigorous cleaning and deduplicating process

[1] Office of Policy Development and Research at U.S. Department of Housing and Urban Development. 2018. "Low Income Housing Tax Credits." Website: https://www.huduser.gov/portal/datasets/lihtc.html.
[2] California Housing Partnership. 2017. "The Tax Credit Turns 30." Website: https://1p08d91kd0c03rlxhmhtydpr-wpengine.netdna-ssl.com/wp-content/uploads/2017/12/TCT30-Final1.pdf.

using both automated processes and manual checks; however, there may be unanticipated inaccuracies in the data received from federal and state agencies.

Each record in the tool represents a single property that is currently receiving support from one or more of the aforementioned federal or state subsidies, loans, grants, or insurance programs. While each property can consist of multiple buildings or sites—or receive simultaneous support from more than one program—only one property name and one address is affiliated with each record. For example, if a single property was financed with a USDA 515 loan and is assisted with a HUD subsidy, the tool represents this property as a single record with both HUD and USDA financing programs attached to the record. Likewise, scattered sites—when several smaller buildings are combined into a single development for the purposes of leveraging tax credits or another form of financing—are also represented as a single record. LIHTC properties that have been resyndicated are likewise represented as a single property record.[3] Each element of a multi-phase or hybrid project financed with LIHTCs, however, is represented as its own, unique record.

The total number of active, affordable rental properties displayed in the tool will change over time as additional properties receive subsidies, subsidies expire or are phased out, and as the subsidy programs themselves evolve. The detailed process of integrating, cleaning, deduplication, and updating is noted below.

Cleaning Procedures

The primary areas for data cleaning center around correcting property addresses, as this field is critical to identifying geographic criteria affiliated with the property (census tract indicators, legislative district, and county location, for example) and is a key matching variable for checking if multiple subsidies are attached to the property, if the property has been resyndicated or has converted to market-rate.

Because property addresses are pulled directly from the administering agency's data, they are first corrected and standardized across the following criteria:

- All spelling errors are corrected
- All extraneous characters and spaces are removed
- All unit and suite numbers are removed

[3] Resyndicated or refinanced properties use the earliest placed-in-service date, but data for the most recent LIHTC award for all other fields (population served, restriction term end, etc.).

All addresses are then verified using the GoogleMaps API. Any addresses that cannot be located using the GoogleMaps API are manually reviewed by looking up the property's name or Assessor Parcel Number (APN) (if available) and cross-checking the property information with the administering agency's data.

After addresses have been corrected and standardized, they are then compared with all other addresses in the Preservation Database to remove duplicate records and identify any properties that are subsidized by multiple programs simultaneously, have been resyndicated or refinanced under a new rental assistance contract or new allocation of tax credits, or are hybrid or multi-phase projects.

Inferences

While most of the social, economic, and environmental benefits captured in the Affordable Housing Map & Benefits Calculator leverage the data provided by the administering agencies and managed in the Preservation Database, some key inputs are inferred:

Number of Family-Sized Units: We assume that all two-bedroom, three-bedroom, four-bedroom or more units are family-serving units, unless the property is targeted for seniors. In this instance, only three-bedroom units and larger are considered family-serving because two-bedroom units likely houses a senior and caretaker.

For properties that do not include data on unit composition, assume 100% of assisted units that are targeted explicitly for families ("large family" or "family" housing types) are family-serving units. Assume 50% of non-targeted and special needs assisted units are family-serving. Assume 0% of seniors are family-serving.

Affordability Term: The affordability term—or the period of time for which units are required to remain affordable by subsidy sources—is calculated manually using the property's regulatory agreement, loan or rental assistance contract start date[4] and end date.[5] When multiple subsidy sources are financing a single property or when a property receives refinancing or resyndication, we use the earliest start date and the latest end date.

Rural Designation: Whether a property is located in a rural census tract is determined by the TCAC/HCD Opportunity Map, which designates all non-metropolitan counties—plus Butte,

[4] Start date is either the placed in service date, the first year of tax credit receipt, or the contract effective date.
[5] For properties that are eligible for prepayment and for which the compliance end year has passed, we assume the exit year is 2020. If the compliance end year has not passed, we assume the prepay eligibility year is the exit year.

Shasta, Sutter, and Yuba Counties—and tracts that are eligible for Section 515 funding as rural areas.[6]

Missing Data: Some properties—especially older ones—are missing key data points, such as placed in service date or bedroom composition. In these instances, we use the California Housing Partnership's expertise in affordable housing finance to make informed assumptions to fill in missing data. If you have questions about these assumptions, contact the California Housing Partnership at https://forms.gle/eqJSVwvPBaPUmqZK7.

Updating Procedures

As new property-level data and research on the social and economic benefits of affordable housing becomes available, we will periodically update the methodology and the Affordable Housing Map and Benefits Calculator's underlying data.

[6] California Fair Housing Task Force. 2021. Opportunity Mapping Methodology. Website: https://www.treasurer.ca.gov/ctcac/opportunity.asp

Calculating Social, Economic, and Environmental Benefits

A large and growing body of research has shaped our understanding of the impacts of affordable housing on residents themselves and on the surrounding community—as a mechanism to increase a family's discretionary income; as a tool for improving health and reducing greenhouse gas emissions; as an essential opportunity for childhood stability, cognitive development, and long-term earnings increases for children; and as a means of generating more local economic activity, job creation, and tax revenue. The Affordable Housing Map and Benefits Calculator draws upon this evidence to estimate, where feasible, both short- and long-term impacts of affordable rental housing in California.

Household Rent Savings

One of the most immediate and fundamental benefits of affordable housing is the reduced rent that enables low-income households to spend more on essentials such as food, health care, child enrichment, and transportation.[7] According to national data, severely cost-burdened low-income households—those paying more than half their income on rent—spend 53% less on these essentials than their low-income counterparts who live in housing that is affordable to them.[8] While not all affordable housing programs guarantee that tenants will pay no more than 30% of income, households that live in subsidized affordable housing generally pay 30-40% of income on rent.

We estimate the rent savings generated by affordable housing as the difference between market rents—the amount households would pay living in the same area were it not for access to rent restricted housing—and affordable rents charged by rental housing with restricted rents. As shown below, we model rent savings over a property's entire affordability term and assume a 3% annual inflation rate to capture rising costs. We further assume a 3% social discount rate to capture the present value of this benefit.[9]

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[7] See, for example: Jacob, Brian, Max Kapustin, and Jens Ludwig. 2015. "The Impact of Housing Assistance on Child Outcomes: Evidence from a Randomized Housing Lottery." *The Quarterly Journal of Economics;* and Aizer, et al. 2014. "The Long Term Impact of Cash Transfers to Poor Families." *NBER Working Paper Number 20103.*

[8] Joint Center for Housing Studies. 2017. "The State of the Nation's Housing." *Harvard University Joint Center for Housing.* Website: https://www.jchs.harvard.edu/sites/default/files/harvard_jchs_state_of_the_nations_housing_2017.pdf

[9] We apply a 3% annual social discount rate, which is approximately the current 30-year Treasury bond rate and in accordance with the social discount rate used by Chetty et al in "The Opportunity Atlas: Mapping the Childhood Roots of Social Mobility" (2018) and Chetty, Hendren, and Katz in "The Effects of Exposure to Better Neighborhoods on Children: New Evidence from the Moving to Opportunity Experiment" (2015).

STEP 1: Estimate the total rent paid by each unit

For LIHTC properties, we use county rent limits posted by the Tax Credit Allocation Committee (TCAC) to determine the total rent paid by each unit annually, by bedroom size and AMI targeting.[10] Because TCAC's property-level data only indicates how many units are targeted for each AMI level—not how many units of each bedroom size—we calculate a weighted average AMI level for the entire property and estimate the total rent paid by each unit with this figure.

For six-bedroom units, which are excluded from TCAC's rent limits, we use HUD's FMR +15% adjustment. HUD does not calculate FMRs or SAFMRs for five- and six-bedroom units and, instead, adjusts rents for larger units by 15%. Accordingly, the FMR for a five-bedroom unit is 1.15 times the four-bedroom FMR and the FMR for a six-bedroom unit is 1.30 times the four-bedroom FMR.[11] Thus, we multiply the four-bedroom rent limit by 1.30 to calculate the rent limit for a six-bedroom unit.

For HUD-financed properties, we use the contract rent amount reported by HUD for each property by bedroom size.

For USDA-financed properties with Section 521 rental assistance—which caps the tenant's rent contribution to 30% of adjusted income—we estimate rent paid by calculating 30% of the average annual income data point reported for each property.

STEP 2: Estimate the total annual rent collected by property

Multiply the number of units for each unit size (studio, one-bedroom, two-bedroom, etc.) by the total rent paid estimate calculated in Step 1 to calculate the rent paid by tenants on a monthly basis across the entire property. Then multiply this value by 12 to calculate the annual rent collected by the property.

STEP 3: Estimate the counterfactual—or the amount of rent a household would pay in the same community in a non-subsidized unit annually

[10] TCAC Income and Rent Limits are available at https://www.treasurer.ca.gov/ctcac/2021/supplemental.asp

[11] Office of the Assistant Secretary for Policy Development and Research. 2017. "Fair Market Rents for the Housing Choice Voucher Program, Moderate Rehabilitation Single Room Occupancy Program and Other Programs Fiscal Year 2017. *Department of Housing and Urban Development*. Website: https://www.govinfo.gov/content/pkg/FR-2016-08-26/pdf/2016-20552.pdf

We use Small Area Fair Market Rents (SAFMR) as a proxy for market rents, which are available by zip code and bedroom size.[12]

For properties with five- and six-bedroom units, we again use HUD's FMR standard for adjusting rents for larger units (+15%).

For the approximately 300 properties in rural areas without SAFMRs, we use Fair Market Rents for the appropriate county.[13]

Then, we multiply the number of units for each unit size (studio, one-bedroom, two-bedroom, etc.) by the total counterfactual—or market rent—to determine total monthly rent collected if there were no affordability restrictions on the property. We then multiply this value by 12 to calculate the hypothesized annual rent collected by the property.

STEP 4: Calculate the difference between market rents and affordable rents

Subtract the value generated in Step 3 by the value generated in Step 2 to determine the total rent savings generated by each property in a single year.

STEP 5: Estimate the total nominal rent savings

We use the sum of geometric sequences formula to calculate the property-wide rent savings generated over a property's entire affordability term.

$$s_1 = a_1\left(\frac{1-r^n}{1-r}\right)$$

s_1: the total nominal rent savings calculated over a property's entire affordability term
a_1: the difference between market rents and affordable rents (calculated in Step 4)
r: annual rate of increase or inflation—we assume a 3% annual inflation rate
n: the affordability term for the property

To estimate the average annual rent savings, we divide S_1 by the property's affordability term.

To estimate the value of this benefit in present dollars, we use the following formula.

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[12] Office of Policy Development and Research. Small Area Fair Market Rents. *Department of Housing and Urban Development*. Website: https://www.huduser.gov/portal/datasets/fmr/smallarea/index.html
[13] Office of Policy Development and Research. Fair Market Rents. *Department of Housing and Urban Development*. Website: https://www.huduser.gov/portal/datasets/fmr.html

$$PV = \left(\frac{FV}{(1+r)^n}\right)$$

PV: the present value of the benefit, or its worth in today's dollars
FV: the future value of the benefit
r: the discount rate—we assume a 3% annual discount rate
n: length of time between the present year and the end of a property's affordability term

Representation in the Affordable Housing Map and Benefits Calculator

In the Affordable Housing Map and Benefits Calculator itself, we represent this benefit in two ways: as monthly household rent savings and as total annual rent savings. At the property level, 'Household Rent Savings (monthly)' is the average monthly rent savings for all units across the property in 2020 dollars. The 'Total Rent Savings (annual)' figure is the total annual rent savings from all units in the property in 2020 dollars.

At the aggregate level—statewide, county, city, and legislative districts—the 'Household Rent Savings (monthly)' figure is the median monthly household rent saving value for all properties included in the selected geography in 2020 dollars. The 'Total Rent Savings (annual)' is the total annual rent savings from all units in all properties in the selected geography in 2020 dollars.

Lifetime Earnings Boost for Children

The long-term impacts on children from living in stable and affordable housing is well-documented in the research literature—including higher academic performance, lifetime earnings increases, reductions in incarceration, and improvements to physical and mental health.[14] Some of these benefits come through access to affordable housing itself, which enables parents to devote a greater share of their family's financial resources to educational and cognitive development opportunities, which improves adult outcomes later in life.[15] Other documented benefits come by virtue of location, when affordable homes help low-income

[14] See, for example: How Housing Matters, a clearinghouse of research on housing's benefits supported by the MacArthur Foundation and the Urban Institute: https:// howhousingmatters.org; and Chetty, Hendren, and Katz. 2015. "The Effects of Exposure to Better Neighborhoods on Children: New Evidence from the Moving to Opportunity Experiment." *The Equality of Opportunity Project*. May.
[15] See, for example: Jacob, Brian, Max Kapustin, and Jens Ludwig. 2015. "The Impact of Housing Assistance on Child Outcomes: Evidence from a Randomized Housing Lottery." *The Quarterly Journal of Economics;* and Aizer, et al. 2014. "The Long Term Impact of Cash Transfers to Poor Families." *NBER Working Paper Number 20103.*

families gain footholds in high-opportunity neighborhoods that offer betters chances at educational attainment and long-term economic mobility.[16]

A 2016 study by Andersson et al found that young adults who live in public or voucher-assisted housing as teenagers have higher earnings and lower rates of incarceration than young adults from unassisted low-income households. The authors found that for every additional year a teen lives in voucher-assisted housing, earnings at the age of 26 increase on average 4.7% for females and 2.6% for males. Every additional year in public housing as a teenager was similarly associated with an increase in age 26 earnings by 4.9% and 5.1% for females and males, respectively. The authors found that these figures are even higher for Non-Hispanic black females and Hispanic females.[17]

Another recent study by Chetty explored the relationship between lifetime earnings and childhood environments. Using longitudinal data from a virtual census of children born around 2018 across the country, Chetty and his colleagues found that growing up in a given region's higher-opportunity neighborhoods was on average associated with $206,000 (in 2015 dollars) in greater lifetime earnings than growing up in the same region's lower-opportunity neighborhoods—or $8,900 (in 2015 dollars) for each year spent in high-opportunity areas rather than lower-opportunity neighborhoods.[18]

As described below, we leverage both Andersson and Chetty's research to model lifetime earnings increases for children growing up in affordable housing and in high-opportunity neighborhoods. We assume a 3% annual rate of increase and a 3% social discount rate to capture the present value of this intertemporally distributed benefit. We also assume that the lifetime earnings boost generated during children is distributed evenly across adulthood. We further assume that the typical length of stay for families with children in affordable housing is three years.

STEP 1: Determine which properties are eligible

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[16] See for example: Chetty, Hendren, and Katz. 2015. "The Effects of Exposure to Better Neighborhoods on Children: New Evidence from the Moving to Opportunity Experiment." *The Equality of Opportunity Project*. May; and Sanbonmatsu, et al. 2011. "Moving to Opportunity for Fair Housing Demonstration Program: Final Impacts Evaluation." Prepared for: U.S. Department of Housing and Urban Development, Office of Policy Development & Research.

[17] Andersson, et al. 2016. "Childhood Housing and Adult Earnings: A Between-Siblings Analysis of Housing Vouchers and Public Housing." *National Bureau of Economic Research*. Working Paper 22721.

[18] Chetty, Raj, John Friedman, Nathaniel Hendren, Maggie R. Jones, Sonya R. Porter. 2018. "The Opportunity Atlas: Mapping the Childhood Roots of Social Mobility." Website: https://opportunityinsights.org/wp-content/uploads/2018/10/atlas_paper.pdf

Because both the Andersson and Chetty studies focus on families with children, we only estimate the lifetime earnings boost for properties with family-sized units.

We also only apply the additional lifetime earnings boost measured in the Chetty study to families in affordable rental properties in high and highest resource areas, which are defined by the TCAC/HCD Opportunity Map as those neighborhoods with characteristics and resources most associated with positive educational and long-term economic outcomes for low-income children. California's two main affordable housing funding agencies, the Tax Credit Allocation Committee (TCAC) and the Department of Housing and Community Development (HCD), adopted these maps in 2018 to inform policies that incentivize affordable housing for families to be located in higher-resource neighborhoods. Areas in each regional map are assigned to one of five categories (highest resource; high resource; moderate resource; moderate resource (rapidly changing); and low resource) based on regionally derived scores for 16 evidence-based neighborhood indicators, or to a sixth category (high segregation and poverty) if they are both racially segregated and high-poverty. Tracts whose opportunity index scores are in the top 20% of each region are categorized as highest resource, and tracts whose scores fall into the next 20% of each region (top 20-40%) are categorized as high resource.[19]

STEP 2: Estimate the number of children in each property at any given time

To estimate the number of children in each property, we assume that 1.5 children reside in each bedroom in a family-sized unit. For properties without bedroom composition data, assume 1.5 children per family unit. Because the Andersson study is only applicable to teenagers, we further assume that 33% of all children are teens (13-18).[20]

STEP 3: Estimate the total number of children housed for the property's full affordability term

We assume that the lifetime earnings benefit applies to each child as defined in Step 2 and that each unit is occupied by the same household for three years. Therefore, we estimate the number of children served for the full affordability term by dividing the affordability term by the three-year length of stay assumption and then multiplying this quotient by the number of children calculated in Step 2. Follow the same process to determine how many teens will experience the earnings increase over the entire affordability term of the property.

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[19] See the California Tax Credit Allocation Committee's website for the full opportunity mapping methodology, as well as an interactive maps and a downloadable file with scores and designations for each tract: http://www.treasurer.ca.gov/ctcac/opportunity.asp.

[20] U.S. Census Bureau. 2013-2017. American Community Survey 5-Year Estimates, Table B17001: Poverty Status in the Past 12 months by Sex by Age.

STEP 4: Estimate the total nominal lifetime earnings boost per child

The Andersson study found that for each year a teenager lives in public housing, their age 26 earnings increase by an average of $498 annually (in 2000 dollars). Because the Andersson study covers the entire United States and California wages are above the national average, we inflate this earnings impact by 6.25%.[21] We also assume that each unit is occupied by the same household for three years and that the age 26 earnings boost is experienced each year of employment. Therefore, we estimate an annual lifetime earnings boost of $1,590 (in 2000 dollars) per teen. We then adjust the earnings estimates for time value of money—accounting for the fact that earnings do not begin until teens are 26 years old and accumulate each year of employment. To estimate the total nominal lifetime earnings increase for each child over their entire career, we use the sum of geometric sequence formula below.

$$s_1 = a_1\left(\frac{1-r^n}{1-r}\right)$$

s_1: the total annual nominal lifetime earnings increase for each child
a_1: the age 26 earnings increase for each child above
r: annual rate of increase or inflation—we assume a 3% annual inflation rate
n: the number of years worked in a lifetime—we assume 40 years

For children living in properties located in high and highest resource census tracts, we apply an additional lifetime earnings boost of $8,900 (in 2015 dollars) for each year spent in the property. Since we do not know the age of children who live in family-targeted affordable housing units, we assume they are, on average, nine years old, that this earnings boost is not experienced until age 18, and that families occupy their respective unit for three years. Because the Chetty study found that each additional year spent in a high resource area has approximately the same effect on a child's adult earnings, we apply the lifetime earnings benefit equally across all years and can assume that for each year a child lives in a high resource area, they experience approximately $8,900 more in adult earnings. Because the TCAC/HCD Opportunity Maps rely on more recent data, we only apply this earnings boost to the children we estimate have and will live in the property since 2010.

To estimate the value of this benefit in present dollars, we use the following formula.

[21] U.S. Department of Housing and Urban Development. 2000. Picture of Subsidized Households for 2000, Individual Wages for Subsidized Housing, All HUD Programs, California and U.S. Total.

$$PV = \left(\frac{FV}{(1+r)^n}\right)$$

PV: the present value of the benefit, or its worth in today's dollars
FV: the future value of the benefit
r: the discount rate—we assume a 3% annual discount rate
n: length of time between the present year and the end of the child's assumed 40-year career

STEP 5: Estimate the total amount of earnings impact for all children in the property

To estimate the total amount of earnings impact for all children in the property, we multiply the total number of children housed for the property's full affordability term from Step 3 by the total amount of earnings impact per child calculated in Step 5.

Representation in the Affordable Housing Map and Benefits Calculator

In the Affordable Housing Map and Benefits Calculator itself, we represent this benefit as 'Lifetime Earnings Boost per Child Housed.' At the property level, this figure is the lifetime earnings boost per child housed in the property in 2020 dollars. At the aggregate level—statewide, county, city, or legislative districts—this figure is the median value of this variable for all properties included in the selected geography in 2020 dollars.

Medical Cost Savings from Reduction in Severe Obesity and Diabetes

A growing "neighborhood effects" literature has shown that affordable housing can provide substantial benefits to low-income households by virtue of its location—as demonstrated, for example, in the Chetty et al study described earlier on long-term positive impacts from living in high-opportunity neighborhoods.[22] Another example of this research comes from a study on the the U.S. Department of Housing and Urban Development's (HUD) Moving to Opportunity (MTO) for Fair Housing experiment, which demonstrated that moving from high-poverty areas to lower-poverty neighborhoods for at least one year substantially reduced the prevalence of diabetes and extreme obesity among adults. A study by Ludwig et al using MTO data showed that a 10 percentage point decline in duration-weighed census tract poverty over ten years was strongly

[22] See for example: Chetty, Hendren, and Katz. 2015. "The Effects of Exposure to Better Neighborhoods on Children: New Evidence from the Moving to Opportunity Experiment." *The Equality of Opportunity Project*. May; and Sanbonmatsu, et al. 2011. "Moving to Opportunity for Fair Housing Demonstration Program: Final Impacts Evaluation." Prepared for: U.S. Department of Housing and Urban Development, Office of Policy Development & Research.

associated with a 6.2 percentage point decline in the probability of class II obesity (BMI ≥ 35), a 4.3 percentage point decline in the probability of class III obesity (BMI ≥ 40), and a 3.2 percentage point decline in the probability of diabetes (glycosylated hemoglobin (HbA1c) ≥ 6.5%)).[23]

We quantify the health improvements for adults living in affordable housing in lower poverty neighborhoods by estimating the financial savings experienced from reductions in the prevalence of diabetes and extreme obesity. As shown below, we model medical cost savings over a property's entire affordability term, assume a 4.4% annual rate of increase in medical expenditures to capture rising medical costs, and apply a 3% social discount rate to capture the present value of this benefit.[24] In addition, because the Ludwig study takes place over a ten-year period but does not indicate exactly when the health improvements emerge, we assume that the health improvements and the subsequent medical cost savings emerge ten years after the family first leases up and is replicated each year the family lives in the property. We assume length of stay is three years.[25] Furthermore, because obesity is a comorbidity with diabetes, we assume that only 85% of adults with class II obesity and 74% of adults with class III obesity do not also have diabetes.[26]

STEP 1: Determine which properties are eligible

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[23] Ludwig et al. 2011. "Neighborhoods, Obesity, and Diabetes—A Randomized Social Experiment." *The New England Journal of Medicine*, 365 (16): 1509-19.

[24] From 1980 to 2015, the per capita national health expenditures have consistently exceeded and grown faster than the Personal Consumption Expenditure Price Index. For this reason, we use Centers for Medicare and Medicaid Services data to estimate the annual nominal growth rate of medical expenses. To be conservative, we use 4.4% or the average health inflation from 2010 to 2020. For more information, see www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NationalHealthAccountsHistorical.html

[25] Research on length of stay in subsidized housing varies based on the demographics of households residing in each unit (race, household size, housing type (family with children vs. senior), household income, the year the household exited the program, etc.) and other characteristics associated with specific housing programs (tenant-based assistance vs. project-based, for example). One 2006 survey conducted by the AARP Public Policy Institute found that non-senior households stay in LIHTC-financed affordable housing for an average of 4.4 years, while senior households stayed for 6.3 years.* A 2017 analysis by HUD's Office of Policy Development and Research found that median length of stay varies notably by program. The special needs households served by Section 202/811 and 202/162 developments had the shortest median length of stay of 1.9 years, while the households in Moving to Work units stayed for 4.4 years. The median length of stay for all programs captured in the study is 2.9 years.** To be conservative, we estimate that all households that live in the affordable housing captured in this data do so for three years.

*AARP Public Policy Institute. 2006. "Developing Appropriate Rental Housing for Low-Income Older Persons: A Survey of Section 202 and LIHTC Property Managers."

** Office of Policy Development and Research. 2017. "Length of Stay in Assisted Housing." *Department of Housing and Urban Development*. Website: https://www.huduser.gov/portal/sites/default/files/pdf/LengthofStay.pdf

[26] Rinzler, Dan, Philip Tegeler, Mary Cunningham, and Craig Pollack. 2015. "Leverage the Power of Place: Using Pay for Success to Support Housing Mobility." *Center for Community Development Investments*.

Because the MTO experiment offered housing vouchers to families with children living public housing, we only estimate medical cost savings for adults living in properties with family-sized units.[27]

We also only calculate this benefit for families in affordable rental properties in census tracts with poverty rates that we believe are lower than where the family would hypothetically live were it not for access to the subsidized property. To determine if a property fits this criteria, we first determine the actual poverty rate for a property's census tract. To account for the possibility that neighborhood poverty rates may have changed over the course of a property's affordability term, we use two poverty rates for each property. The first poverty rate is based on the property's placed in service year and the closest corresponding decennial census.[28] For example, a property that was placed in service in 2004 uses the poverty rate from the 2000 decennial census. A property that was placed in service in 2005 uses the poverty rate from 2010 decennial census. The second poverty rate for each property is the 2019 poverty rate as reported by the American Community Survey.[29]

Next, we estimate the counterfactual tract poverty rate—or the hypothesized poverty rate for low-income households were it not for access to subsidized units. We assume that a reasonable counterfactual tract poverty rate is equivalent to the average census tract poverty rate in each region for family properties in the Preservation Database. Regions are determined by the TCAC geographic regions, as articulated in the TCAC regulations for allocating tax credits.[30]

Next, we calculate the difference between the hypothesized counterfactual census tract poverty rate and the actual census tract poverty rate for each of the two poverty rate categories (placed in service poverty rate and 2019 poverty rate). All properties that are located in census tracts with poverty rates that are lower than the hypothesized counterfactual census tract by five percentage points or more are eligible for this benefit.

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[27] See the Methodology section (Data Integration, Cleaning, Deduplication, and Updating subsection) for details on the process used to determine family-sized units.
[28] See Opportunity Insights' Data Library for each decade's census tract poverty rates. Accessed December 2018 at https://opportunityinsights.org/data/. Poverty rate by census tract is also available via American Fact-Finder. U.S. Census Bureau, Census 2000 Summary File 3, Matrices P30, P32, P33, P43, P46, P49, P50, P51, P52, P53, P58, P62, P63, P64, P65, P67, P71, P72, P73, P74, P76, P77, P82, P87, P90, PCT47, PCT52, and PCT53.
[29] U.S. Census Bureau. 2015-2019. American Community Survey 5-Year Estimates.
[30] California Tax Credit Allocation Committee. 2021. "California Tax Credit Allocation Committee Regulations Implementing the Federal and State Low Income Housing Tax Credit Laws." Website: https://www.treasurer.ca.gov/ctcac/programreg/2021/20210616/2021-regulations-clean.pdf

STEP 2: Estimate the average decline in duration-weighted census tract poverty over a ten-year period

For each of the first three years where the family is hypothesized to live in the property, assume a decline in the poverty rate equivalent to the delta calculated in Step 1. For the remaining seven years of the ten-year period, we assume that there is no additional decline in poverty rate, expecting that after a family moves out of the affordable unit, they live in a neighborhood with a poverty rate similar to the hypothesized counterfactual poverty rate for that region. We then divide the total delta by ten. This number is the hypothesized change in duration-weighted tract poverty over the ten-year period.

STEP 3: Estimate the change in prevalence of type II obesity, type III obesity, and diabetes

Because the Ludwig study found that a 10 percentage point drop in duration-weighted tract poverty over ten years is associated with declines in the probability of class II obesity, class III obesity, and diabetes of 6.2, 4.3, and 3.2 percentage points, respectively, the percentage point difference for each health category is equivalent to the delta calculated in Step 2 times 0.62, 0.43, and 0.32, respectively.

STEP 4: Estimate the number of adults impacted in each property

We estimate the number of adults living in the property at any given time by multiplying 1.5 by the number of family units.

To then calculate the number of adults impacted by the expected decline in obesity and diabetes prevalence, we multiply the number of adults living in the property by the expected change in likelihood of having diabetes and obesity as calculated in Step 3.

STEP 5: Estimate the medical cost savings associated with the declining prevalence of type II obesity, type III obesity, and diabetes

We estimate the medical cost savings associated with lower prevalence of type II obesity, type III obesity, and diabetes by multiplying the number of adults impacted from Step 4 by the expected annual medical expenditures for obesity and diabetes.

On average, people diagnosed with diabetes incur $9,601 annual medical costs directly attributable to diabetes (in 2017 dollars).[31] To be conservative, we assume that for the adults

[31] American Diabetes Association. 2018. "The Cost of Diabetes." *American Diabetes Association.* Accessed in Dec 2018. Website: http://www.diabetes.org/advocacy/news-events/cost-of-diabetes.html

who live in affordable rental housing and have diabetes, their annual medical costs associated with diabetes is $8,000 (in 2017 dollars). Accordingly, we assume that elimination of the disease is associated with medical cost savings equivalent to this amount. We also assume a 4.4% annual nominal growth rate in savings due to rising medical costs.

Similarly, people with obesity and class III obesity (or severe obesity) incur annual medical costs directly attributable to obesity of $1,723 and $3,012 (in 2008 dollars), respectively. Because the research does not distinguish costs of class II obesity, specifically, we conservatively apply the costs associated with adults with BMI of 30 or greater.[32] We again assume a 4.4% annual nominal growth rate in savings due to rising medical costs.

STEP 6: Estimate the total nominal medical cost savings associated with the declining prevalence of type II obesity, type III obesity, and diabetes for each property's full affordability term

To estimate the total nominal medical cost savings from the declining prevalence of type II obesity, type III obesity, and diabetes for a property's entire affordability term, we use the sum of geometric sequence formula below.

$$s_1 = a_1\left(\frac{1-r^n}{1-r}\right)$$

s_1: the total nominal medical cost savings calculated over a property's entire affordability term (calculated separately for diabetes, type II obesity, and type III obesity)
a_1: annual medical cost savings for all adults in the property at a given time (calculated in Step 5) that begin after ten years
r: annual rate of increase or inflation—we assume a 4.4% annual inflation rate
n: the affordability term for the property

To estimate the average annual medical cost savings, we divide S_1 by the property's affordability term.

To estimate the value of this benefit in present dollars, we use the following formula.

$$PV = \left(\frac{FV}{(1+r)^n}\right)$$

PV: the present value of the benefit, or its worth in today's dollars

[32] Tsai, Adam Gilden, David F. Williamson, and Henry A. Glick. 2011. "Direct medical cost of overweight and obesity in the United States: a quantitative systematic review." *Obesity Review*. January. Vol 12, Issue 1. 50-61.

FV: the future value of the benefit
r: the discount rate—we assume a 3% annual discount rate
n: length of time between the present year and the end of a property's affordability term

Representation in the Affordable Housing Map and Benefits Calculator

In the Affordable Housing Map and Benefits Calculator itself, we represent this benefit as 'Medical Cost Savings from Severe Obesity and Diabetes Reductions'. At the property level, this figure is the average annual medical cost savings for the property in 2020 dollars. At the aggregate level—statewide, county, city, or legislative districts—this figure is the total medical cost savings for all properties included in the selected geography in 2020 dollars.

Pediatric Health Savings from Living in a Lower Poverty Community

As described above, a strong and expanding body of research has shown that affordable housing can provide substantial benefits to low-income households by virtue of its location: living in lower-poverty and higher resource neighborhoods can improve educational attainment, long-term economic mobility, and health outcomes for adults and children.[33]

For example, a study by Pollack et al—using data from HUD's Moving to Opportunity (MTO) experiment—found that a 10 percentage point decline in duration-weighed census tract poverty was strongly associated with $133 less in yearly hospital spending for children (2015 dollars).[34] We leverage this finding to estimate the impact of reduced healthcare spending for children living in affordable housing in lower poverty neighborhoods. As shown below, we model pediatric health savings over a property's entire affordability term, assume a 4.4% annual rate of increase in medical expenditures to capture rising medical costs, and apply a 3% social discount rate to capture the present value of this benefit.[35] In addition, because the Pollack study relies on follow-up data from up to 21 years after randomization and finds results of a similar

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[33] See for example: Chetty, Hendren, and Katz. 2015. "The Effects of Exposure to Better Neighborhoods on Children: New Evidence from the Moving to Opportunity Experiment." *The Equality of Opportunity Project*. May; and Sanbonmatsu, et al. 2011. "Moving to Opportunity for Fair Housing Demonstration Program: Final Impacts Evaluation." Prepared for: U.S. Department of Housing and Urban Development, Office of Policy Development & Research.

[34] Pollack. 2019. "Association of Receipt of a Housing Voucher with Subsequent Hospital Utilization and Spending." *JAMA*, 322 (21): 2115-2124.

[35] From 1980 to 2015, the per capita national health expenditures have consistently exceeded and grown faster than the Personal Consumption Expenditure Price Index. For this reason, we use Centers for Medicare and Medicaid Services data to estimate the annual nominal growth rate of medical expenses. To be conservative, we use 4.4% or the average health inflation from 2010 to 2020. For more information, see www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NationalHealthAccountsHistorical.html

magnitude throughout the study period, we assume that the annual reduction in health care spending persists across a child's full lifetime.

STEP 1: Determine which properties are eligible

Because the MTO experiment offered housing vouchers to families with children living public housing, we only estimate pediatric health savings for properties with family-sized units.[36]

We also only calculate this benefit for families in affordable rental properties in census tracts with poverty rates that we believe are lower than where the family would hypothetically live were it not for access to an affordable home. To determine if a property fits this criterion, we first determine the actual poverty rate for a property's census tract. To account for the possibility that neighborhood poverty rates may have changed over the course of a property's affordability term, we use two poverty rates for each property. The first poverty rate is based on the property's placed in service year and the closest corresponding decennial census.[37] For example, a property that was placed in service in 2004 uses the poverty rate from the 2000 decennial census. A property that was placed in service in 2005 uses the poverty rate from 2010 decennial census. The second poverty rate for each property is the 2019 poverty rate as reported by the American Community Survey.[38]

STEP 2: Estimate the average decline in duration-weighted census tract poverty

Next, we estimate the counterfactual tract poverty rate—or the hypothesized poverty rate for low-income households were it not for access to subsidized units. We assume that a reasonable counterfactual tract poverty rate is equivalent to the average census tract poverty rate in each region for family properties in the Preservation Database. Regions are determined by the TCAC geographic regions, as articulated in the TCAC regulations for allocating tax credits.[39]

Next, we calculate the difference between the hypothesized counterfactual census tract poverty rate and the actual census tract poverty rate for each of the two poverty rate categories (placed in service poverty rate and 2019 poverty rate). All properties that are located in census tracts

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[36] See the Methodology section (Data Integration, Cleaning, Deduplication, and Updating subsection) for details on the process used to determine family-sized units.
[37] See Opportunity Insights' Data Library for each decade's census tract poverty rates. Accessed December 2018 at https://opportunityinsights.org/data/. Poverty rate by census tract is also available via American Fact-Finder. U.S. Census Bureau, Census 2000 Summary File 3, Matrices P30, P32, P33, P43, P46, P49, P50, P51, P52, P53, P58, P62, P63, P64, P65, P67, P71, P72, P73, P74, P76, P77, P82, P87, P90, PCT47, PCT52, and PCT53.
[38] U.S. Census Bureau. 2015-2019. American Community Survey 5-Year Estimates.
[39] California Tax Credit Allocation Committee. 2021. "California Tax Credit Allocation Committee Regulations Implementing the Federal and State Low Income Housing Tax Credit Laws." Website: https://www.treasurer.ca.gov/ctcac/programreg/2021/20210616/2021-regulations-clean.pdf

with poverty rates that are lower than the hypothesized counterfactual census tract by five percentage points or more are eligible for this benefit.

For each of the three years where the family is hypothesized to live in the property, assume a decline in the poverty rate equivalent to the delta calculated above.

STEP 3: Estimate the number of children in each property at any given time

To estimate the number of children in each property, we assume that 1.5 children reside in each bedroom in a family-sized unit. For properties without bedroom composition data, we assume 1.5 children per family unit.

STEP 4: Estimate the total number of children housed for the property's full affordability term

We assume that the health care spending reduction estimated by the Pollack et al paper applies to each child as defined in Step 3 and that each unit is occupied by the same household for three years. Therefore, we estimate the number of children served for the full affordability term by dividing the affordability term by the three-year length of stay assumption and then multiplying this quotient by the number of children calculated in Step 3. Follow the same process to determine how many teens will experience the earnings increase over the entire affordability term of the property.

STEP 5: Estimate the average annual pediatric health savings associated with living in a low poverty neighborhood

We use the variables described above to estimate the pediatric health savings associated with living in a low poverty neighborhood using the following two formulas:

$$a_1 = (change\ in\ neighborhood\ poverty_1/0.10) * \$133$$

a_1: annual pediatric health savings associated with living in a lower poverty neighborhood
$133: annual pediatric health savings in the property at a given time (in 2015 dollars)

To then estimate the total nominal pediatric health savings from living in a lower poverty neighborhood for a property's entire affordability term, we use the sum of geometric sequence formula below:

$$s_1 = a_1\left(\frac{1-r^n}{1-r}\right)$$

s_1: the total nominal pediatric health savings calculated over a property's entire affordability term
a_1: annual pediatric health savings associated with living in a lower poverty neighborhood (calculated above)
r: annual rate of increase or inflation—we assume a 4.4% annual inflation rate
n: the number of years the pediatric health savings accrue—we assume 70 years[40]

To estimate the average annual pediatric health savings, we divide S_1 by the property's affordability term.

To estimate the value of this benefit in present dollars, we use the following formula.

$$PV = \left(\frac{FV}{(1+r)^n}\right)$$

PV: the present value of the benefit, or its worth in today's dollars
FV: the future value of the benefit
r: the discount rate—we assume a 3% annual discount rate
n: length of time between the present year and the end of a property's affordability term

Representation in the Affordable Housing Map and Benefits Calculator

In the Affordable Housing Map and Benefits Calculator itself, we represent this benefit as 'Pediatric Health Savings from Living in a Lower Poverty Community'. At the property level, this figure is the average annual pediatric health savings for the property in 2020 dollars. At the aggregate level—statewide, county, city, or legislative districts—this figure is the total pediatric health savings for all properties included in the selected geography in 2020 dollars.

Medical Cost Savings from Reduction in Pediatric Asthma ED Visits

As described above, the long-term benefits for children from living in stable, safe, and affordable housing during childhood is well-documented in the literature—including higher academic performance, lifetime earnings increases, reductions in incarceration, and improvements to

[40] We assume these health care spending reductions accrue for 70 years because the average life expectancy for Californians is 81, the average age for children in the Pollack study is 8 years old, and the benefit is observed 3 years after randomization in the Pollack study. 70 = 81 – (8+3).

physical and mental health.[41] Many of these benefits come through access to affordable housing itself, which enables parents to devote a greater share of their family's financial resources to non-housing expenses—like health care, food, educational opportunities, etc.[42] For example, a 2020 study by Boudreaux, Fenelon, Slopen, and Newman found that participation in a housing assistance program was associated with fewer asthma emergencies in children. This research found that among children with asthma attacks, those whose families received housing assistance were 25-30% less likely to visit the emergency department than children from households on a waiting list for housing assistance.[43]

As described below, we leverage the Boudreaux et al research to estimate the impact of living in affordable housing on pediatric asthma ED visits and their associated costs. We assume a 4.4% annual rate of increase in medical expenditures to capture rising medical costs and apply a 3% social discount rate to capture the present value of this benefit.[44] We further assume that the typical length of stay for families with children in affordable housing is three years.

STEP 1: Determine which properties are eligible

Because the Boudreaux study focuses on families with children, we only estimate the reduction of pediatric asthma ED visits and associated savings for properties with family-sized units.[45]

STEP 2: Estimate the number of children impacted by the expected decline in asthma-related ED visits

We estimate the number of children with asthma by multiplying the number of children in each development by 10.1%—the share of children in low-income households with asthma in the

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[41] See, for example: How Housing Matters, a clearinghouse of research on housing's benefits supported by the MacArthur Foundation and the Urban Institute: https:// howhousingmatters.org; and Chetty, Hendren, and Katz. 2015. "The Effects of Exposure to Better Neighborhoods on Children: New Evidence from the Moving to Opportunity Experiment." *The Equality of Opportunity Project*. May.

[42] See, for example: Jacob, Brian, Max Kapustin, and Jens Ludwig. 2015. "The Impact of Housing Assistance on Child Outcomes: Evidence from a Randomized Housing Lottery." *The Quarterly Journal of Economics;* and Aizer, et al. 2014. "The Long Term Impact of Cash Transfers to Poor Families." *NBER Working Paper Number 20103.*

[43] Boudreaux, Michel, Andrew Fenelon, Natalie Slopen, and Sandra J. Newman. 2020. "Association of Childhood Asthma with Federal Rental Assistance." *JAMA Pediatrics* 6242 (10).

[44] From 1980 to 2015, the per capita national health expenditures have consistently exceeded and grown faster than the Personal Consumption Expenditure Price Index. For this reason, we use Centers for Medicare and Medicaid Services data to estimate the annual nominal growth rate of medical expenses. To be conservative, we use 4.4% or the average health inflation from 2010 to 2020. For more information, see www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NationalHealthAccountsHistorical.html

[45] See the Methodology section (Data Integration, Cleaning, Deduplication, and Updating subsection) for details on the process used to determine family-sized units.

United States.[46] To estimate the number of children in each property, we assume that 1.5 children reside in each bedroom in a family-sized unit. For properties without bedroom composition data, we assume 1.5 children per family unit. We further assume that each unit is occupied by the same household for three years. Therefore, we estimate the total number of children served for the full affordability term by dividing the affordability term by the three-year length of stay assumption and then multiplying this quotient by the number of children calculated above.

Next, we estimate the number of children with an asthma attack by multiplying the number of children with asthma in each property by 43.6%—the share of children living in HUD-assisted housing with an asthma diagnosis who have an attack during a given year.[47]

To then calculate the number of children impacted by the expected decline in asthma-related ED visits, we multiply the number of children with an asthma attack calculated above by the expected change in likelihood of an asthma-related ED visit measured by the Boudreaux study. This study found that among children with an asthma attack in the last year, living in public or multifamily affordable housing was associated with a reduced use of emergency departments for asthma of 36.6 percentage points—from 60.7% of children (quasi-waitlist control group) to 24.1% (children living in public or multifamily housing).[48] Therefore:

$$number\ of\ children\ impacted = ((\#\ of\ children\ in\ the\ development * 0.101) * 0.436) * (0.607 - 0.366)$$

STEP 3: Estimate the total nominal medical cost savings per property

We estimate the medical cost savings associated with a lower prevalence of emergency department use for pediatric asthma by multiplying the number of children impacted from Step 2 by the expected annual medical expenditures for asthma-related ED visits.

On average, asthma-related ED visits among children cost $433 per visit (in 2011 dollars).[49] To be conservative, we assume that children with an asthma-related ED visit only experience one such emergency each year. Therefore:

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[46] National Center for Health Statistics. Health, United States, 2019: Table 12. Hyattsville, MD. 2021. Available from: https://www.cdc.gov/nchs/hus/contents2019.htm

[47] Boudreaux, Michel, Andrew Fenelon, Natalie Slopen, and Sandra J. Newman. 2020. "Association of Childhood Asthma with Federal Rental Assistance." *JAMA Pediatrics* 6242 (10).

[48] Ibid.

[49] Pearson et al. 2014. "State-Based Medicaid Costs for Pediatric Asthma Emergency Department Visits." *Preventing Chronic Disease* 11:140139. Website: http://dx.doi.org/10.5888/pcd11.140139

$$a_1 = \#\ of\ children\ impacted * \$433$$

We also assume a 4.4% annual nominal growth rate in savings due to rising medical costs.

STEP 4: Estimate the total nominal medical cost savings associated with a decline in asthma-related ED visits for each property's full affordability term

To estimate the total nominal medical cost savings from the decline in asthma-related ED visits for children for a property's entire affordability term, we use the sum of geometric sequence formula below.

$$s_1 = a_1\left(\frac{1-r^n}{1-r}\right)$$

s_1: the total nominal medical cost savings calculated over a property's entire affordability term
a_1: the total nominal medical cost savings per property (calculated in Step 3)
r: annual rate of increase or inflation—we assume a 4.4% annual inflation rate
n: the affordability term for the property

To estimate the average annual medical cost savings, we divide S_1 by the property's affordability term.

To estimate the value of this benefit in present dollars, we use the following formula.

$$PV = \left(\frac{FV}{(1+r)^n}\right)$$

PV: the present value of the benefit, or its worth in today's dollars
FV: the future value of the benefit
r: the discount rate—we assume a 3% annual discount rate
n: length of time between the present year and the end of a property's affordability term

Representation in the Affordable Housing Map and Benefits Calculator

In the Affordable Housing Map and Benefits Calculator itself, we represent this benefit as 'Medical Cost Savings from Reduction in Pediatric Asthma ED Visits'. At the property level, this figure is the average annual medical cost savings for the property in 2020 dollars. At the aggregate level—statewide, county, city, or legislative districts—this figure is the total medical cost savings for all properties included in the selected geography in 2020 dollars.

Community Economic Benefits: Jobs, Income, and Taxes

Residential construction generates economic activity in the form of jobs and income for local residents and businesses, and tax revenue for state and local governments. To estimate the local economic benefits generated from the development of multifamily rental housing, we use the National Association of Home Builders (NAHB) economic benefits model to estimate the effect of construction activity, the economic ripple impact that occurs when income from construction activity is spent, and the ongoing economic impact once homes are occupied. The NAHB model quantifies three different categories of economic impacts—jobs supported, state and local taxes generated, and total income generated in California, which includes business owners' income and wages/salaries—over the three phases of property's lifecycle (impact of construction activity, ripple effects of construction, and ongoing effects).[50]

STEP 1: Estimate the per-unit economic impacts of developing and leasing up multifamily rental housing

We use the NAHB multipliers for all three economic impacts across all three phases to estimate the jobs supported, state and local taxes generated, and total income generated per unit of multifamily housing development.

STEP 2: Apply an adjustment for acquisition/rehabilitation properties

The construction phase economic impacts of the NAHB model are based on new construction activity, not acquisition/rehabilitation, the latter of which is typically less expensive and elaborate than new construction.[51] Therefore, we take a conservative approach and assume that all acquisition/rehabilitation properties generate 50% of the per-unit economic impacts of new construction activity estimated in Step 1.

STEP 3: Estimate the total nominal economic impacts of developing and leasing up multifamily housing

[50] Housing Policy Department. 2016. "The Economic Impact of Home Building in California: Income, Jobs, and Taxes Generated." *National Association of Home Builders.*

[51] See, for example: Center for Housing Policy. "Comparing the Costs of New Construction and Acquisition-Rehab in Affordable Multifamily Rental Housing: Applying a New Methodology for Estimating Lifecycle Costs." 2013. Website: https://pdfs.semanticscholar.org/5337/abc2544ae5820a1bc92e52ce3d8f6d5fb8f9.pdf.

Construction activity impacts (phase 1 and phase 2) are only applied for one year and is the product of the NAHB multiplier in construction year dollars and the total number of units in the property.

The ongoing impact that results from homes being occupied accumulates annually for the property's entire affordability term (phase 3). We use the sum of geometric sequence to calculate phase 3 impacts for the property's full affordability term.

$$s_1 = a_1\left(\frac{1-r^n}{1-r}\right)$$

s_1: the total nominal ongoing economic impacts that result from multifamily homes being occupied (phase 3)
a_1: the product of the NAHB multiplier for phase 3 impacts and the total number of units in the property
r: annual rate of increase or inflation—we assume a 3% annual inflation rate
n: the affordability term for the property

We then sum the economic impacts generated during all three phases to estimate the total nominal economic impacts of developing and leasing up multifamily housing.

To estimate the average annual economic impact, we divide the sum of phases 1, 2, and 3 calculated above by the property's affordability term.

To estimate the value of this benefit in present dollars, we use the following formula.

$$PV = \left(\frac{FV}{(1+r)^n}\right)$$

PV: the present value of the benefit, or its worth in today's dollars
FV: the future value of the benefit
r: the discount rate—we assume a 3% annual discount rate
n: length of time between the present year and the end of a property's affordability term

Representation in the Affordable Housing Map and Benefits Calculator

In the Affordable Housing Map and Benefits Calculator itself, we represent these economic benefits as 'Jobs Supported,' 'Wages and Business Income Generated,' and 'State and Local Taxes Generated.' At the property level, each of the three values is the average annual economic impact—jobs supported, income generated, and taxes generated—for the property in 2020

dollars. At the aggregate level—statewide, county, city, or legislative districts—this figure is the total economic impact for all properties in the selected geography in 2020 dollars.

Greenhouse Gas Emission Reductions from Proximity to Transit and Jobs

In California, passenger vehicles alone are responsible for nearly one-third of all greenhouse gas (GHG) emissions. Rates of vehicle ownership and vehicle miles traveled (VMTs) are at all-time highs, partly due to urban sprawl and longer commutes resulting from building low-density housing away from public transit and job centers.[52] In addition to the negative environmental effects of GHG emissions, commuters' reliance on cars result in higher rates of exposure to carcinogens and increased air pollution, the latter of which often most directly affects low-income and BIPOC (Black, Indigenous, and people of color) communities due to the racist and destructive legacy of California's freeway system.[53]

A growing body of research shows that locating affordable homes near transit, jobs, and community amenities helps reduce reliance on cars, thereby reducing greenhouse gas emissions. Affordable, walkable, and transit-proximate housing allows low-income families to reduce their need for driving and navigate their communities, which in turn reduces the amount of greenhouse gases emitted from residents relying on cars to commute to jobs and other frequent destinations.[54]

As described below, we leverage the existing quantification methodologies created by the California Air Resources Board (CARB)[55] and the California Air Pollution Control Officers Association (CAPCOA)[56] to estimate GHG emission reductions associated with locating affordable homes near public transit and job centers. These two mitigation strategies represent only a portion of the total GHG emission reductions made possible by affordable, location-efficient housing. Due to data limitations, we are unable to estimate the impact of increased density, mixed-use development, parking reductions, energy efficient building materials and features,

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[52] See, for example: Next10. 2019. "2019 California Green Innovation Index." https://www.next10.org/publications/2019-gii.
[53] See, for example: Sherman, Bradford P. 2014. "Racial Bias and Interstate Highway Planning: A Mixed Methods Approach" *CUREJ: College Undergraduate Research Electronic Journal*, University of Pennsylvania, https://repository.upenn.edu/curej/176.
[54] See, for example: Reid Ewing and Robert Cervero. 2010. "Travel and the Built Environment: A Meta-Analysis," *Journal of the American Planning Association* 76, No. 3: 10
[55] California Air Resources Board. 2020. "Quantification Methodology." https://ww2.arb.ca.gov/sites/default/files/auction-proceeds/sgc_ahsc_qm_022521.pdf?a=88
[56] California Air Pollution Control Officers Association. 2010. "Quantifying Greenhouse Gas Mitigation Measures." http://www.capcoa.org/wp-content/uploads/downloads/2010/09/CAPCOA-Quantification-Report-9-14-Final.pdf

supply chain innovations, fuel efficiency, and decarbonization, all of which have been shown to yield greenhouse gas emission reductions.[57]

STEP 1: Calculate unmitigated VMTs

We first estimate the expected vehicle miles traveled (VMT) by residents of each property using the unmitigated VMT calculations provided by CARB. This calculation uses car trip length averages (for work, shopping, and other) by county and average trip frequency based on development density, combined with the number of residents in a property, to estimate the annual unmitigated VMT value for that property.

$$annual\ unmitigated\ VMT = average\ daily\ trils * overall\ trip\ length * total\ units * 365\ days$$

average daily trips: average daily trip rate per unit (equation 1 in CARB's AHSC QM)[58]
overall trip length: county-specific average length for urban or rural home-based trips (equation 3 in CARB's AHSC QM)[59]
total units: number of dwelling units in the affordable housing development

Building height is a necessary component of the average daily trips calculation for the formula above but is not currently captured in the Preservation Database. We estimate this figure using data from CoStar's Multifamily Rental Database to model the number of stories for each affordable housing development based on the number of units and the census tract in which it is located. When tract-level estimates are unreliable due to low sample sizes, we use county-level estimates.[60]

STEP 2: Calculate distance to the nearest transit stop

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[57] See, for example: California Air Pollution Control Officers Association. 2010. "Quantifying Greenhouse Gas Mitigation Measures." http://www.capcoa.org/wp-content/uploads/downloads/2010/09/CAPCOA-Quantification-Report-9-14-Final.pdf (pgs. 155-309)
[58] California Air Resources Board. 2020. "Quantification Methodology." https://ww2.arb.ca.gov/sites/default/files/auction-proceeds/sgc_ahsc_qm_022521.pdf?a=88
[59] Ibid.
[60] To further validate the number of stories estimate, we use several additional data checks. Tracts where there are not enough multifamily properties to generate estimates for one or any building height category are assigned the 'Low-Rise' designation, with the assumption that a tract with such a low occurrence of multifamily properties is unlikely allow or encourage mid- or high-rise development. We also compared the low-, mid-, and high-rise unit limits to the existing properties in the CoStar database, identifying any outlier tracts and using county data instead.

To calculate the distance from each affordable housing development to the nearest transit stop, we first assemble transit stop maps from regional and local transit data published by regional GIS sites and GTFS data published by OpenMobilityData, a transit data aggregation site.[61] Data for the Central Valley region was provided to us by researchers at the Center for Neighborhood Technology and UC Davis, who created a transit layer for this region as part of a 2019 study.[62] Given limitations in transit data availability and transparency, the Affordable Housing Map and Benefits Calculator includes transit stop data for the Bay Area, Los Angeles County, Central Valley, Sacramento region, and San Diego. While data for other areas of the state is not currently available, we hope to add additional regions in future updates of the tool as data quality and coverage improves.

The GHG emission reduction methodologies used in this calculation require that transit stops meet the threshold for "high quality transit" used by state programs and defined as rail stops or bus rapid transit with a peak period frequency of 15 minutes or less and service seven days per week. Some county and regional GIS department publish High Quality Transit Area (HQTA) maps, which we used where possible. In areas where HQTA maps were not available, we cleaned the transit data collected from the GTFS site to only include transit stops that meet the high quality transit definition.

We then calculate the distance from each affordable housing development to the nearest high quality transit stop.

STEP 3: Calculate distance to nearest central business district

To identify job centers, we use the Central Business Districts Map created by CARB for the Affordable Housing and Sustainable Communities (AHSC) program, which identifies areas with a high concentration of jobs throughout the state.[63] Central Business Districts are defined as census tracts with at least 5,000 jobs per square mile, using 2018 U.S. Census data.

We then calculate the distance from each affordable housing development to the boundary of the nearest central business district. Properties located within the bounds of a central business district are assigned a value of 0 miles.

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[61] OpenMobilityData. https://transitfeeds.com/l/154-los-angeles-ca-usa. Accessed September 2021.
[62] California Coalition for Rural Housing. 2019. "High Amenity Parcels in the San Joaquin Valley." https://ucdavis.maps.arcgis.com/apps/webappviewer/index.html?id=b738a5fb118348ada4f74cc3d7bdffd9&extent=-13794391.0164%2C4176158.8082%2C-12855132.8128%2C4593199.2345%2C102100
[63] California Air Resources Board. "AHSC Quantification Methodology: Central Business District Map." https://ww2.arb.ca.gov/sites/default/files/auction-proceeds/kml/jobcentermap.htm. Accessed April 2021.

STEP 4: Calculate % VMT reduction from proximity to transit

We then calculate the percent VMT reduction associated with proximity to transit using the CAPCOA quantification methodology's "Increase Transit Accessibility" formula. The formula varies based on each development's distance to the closest high quality transit stop (calculated in step 2):

(1) 0-0.5 miles to nearest stop: $\frac{[((-50*distance\ to\ transit\ stop + 38) - 1.3)*0.67]}{100}$

(2) 0.5-3 miles to nearest stop: $\frac{[((-4.4*distance\ to\ transit\ stop + 15.2) - 1.3)*0.67]}{100}$

(3) > 3 miles to nearest stop: No impact

In order to stay consistent with the CAPCOA methodology, the VMT reduction for properties 0-0.5 miles from the nearest transit stop is capped at 24.6%, and VMT reduction for properties 0.5-3 miles from the nearest transit stop is capped at 13%.

STEP 5: Calculate % VMT reduction from proximity to jobs

Next, we calculate the percent VMT reduction associated with an affordable housing development's proximity to the nearest Central Business District using the "VMT Reduction from Increased Destination Accessibility" formula from the AHSC quantification methodology created by CARB. The formula is as follows:

$$accessibility\ VMT\ reduction = \left(\frac{12\ miles - distance\ to\ nearest\ central\ business\ district}{12\ miles}\right) * 20\%$$

The jobs proximity VMT reduction is capped at 20%.

STEP 6: Calculate the VMT reduction from integration of affordable housing

We calculate the percent VMT reduction associated with the integration of affordable housing using CARB AHSC's quantification methodology:

$$affordability\ VMT\ teduction = \left(\frac{affordable\ units}{total\ units}\right) * 0.04$$

STEP 7: Calculate the total VMT reduction and distribute to transit and jobs benefits

The interactions between the three mitigation measures estimated above is complex and sometimes counterintuitive. To ensure the accuracy and reliability of the methods, the CARB and CAPOA methodologies employ the following formula to account for the diminished benefit of

each additional mitigation measure, rather than adding all measures together directly.[64] The VMT reductions associated with various mitigation measures could add up to 110% for a single development and so this formula is designed to account for the interaction between the mitigation measures:

$$total\ VMT\ reduction = (1 - (1 - transit) * (1 - jobs) * (1 - integration)$$

transit: % VMT reduction from proximity to transit (Step 4)
jobs: % VMT reduction from proximity to jobs (Step 5)
integration: 4% VMT reductions from the integration of affordable housing (Step 6)

This formula produces a percentage reduction in VMT considering the interaction between the three components calculated thus far. This single percentage reduction is then distributed into two distinct benefits—VMT reduction from proximity to transit and VMT reduction from proximity to jobs—according to their proportion of the total reduction plus 50% of the integration of affordable housing benefit calculated in Step 6.

STEP 8: Calculate total VMT reductions for proximity to transit and jobs

Next, we calculate the total VMT reduction associated with proximity to transit and proximity to jobs by multiplying the results from Step 7 by the unmitigated VMTs calculated in Step 1. This step yields the VMT reductions associated with proximity to transit and proximity to jobs, represented as two distinct values.

STEP 9: Convert VMTs to metric tons of CO_2 ($MTCO_2$)

Next, we convert the vehicle miles traveled (VMT) reduction from proximity to both transit and jobs calculated in Step 8 to annual greenhouse gas emissions or metric tons of CO_2 ($MTCO_2$). This step uses county emissions factors, or the grams of CO_2 per vehicle mile traveled, which are published by CARB; emissions factors vary by county based on vehicle types and rates of car ownership.[65] The formula for calculating annual GHG emission reductions is as follows:

$$GHG\ Emission\ Reduction_{transit}\ (MTCO_2)\ =\ (Annual\ Avoided\ VMT_{transit}\ *\ EFyr1)\ *\ U^{(-1)}$$

[64] The VMT reductions associated with various mitigation measures could add up to 110% for a single development and so this formula is designed to account for the interaction between the mitigation measures.
[65] California Air Resources Board. "California Climate Investments Quantification Methodology Emission Factor Database Documentation." Accessed October 2021. http://ww2.arb.ca.gov/sites/default/files/auction-proceeds/ef_database_documentation.pdf

$$GHG\ Emission\ Reduction_{jobs}\ (MTCO_2)\ =\ (Annual\ Avoided\ VMT_{jobs}\ *\ EFyr1)\ *\ U^{(-1)}$$

annual avoided VMT: annual reductions in baseline VMT, from Step 1
EFyr[1]: the emission factor calculated by CARB for each county for 2021 (gCO_2/mile)
U: unit conversion factor, in this case 1,000,000 g/MT

With the completion of this step, we have calculated the annual GHG reduction associated with proximity to transit and proximity to jobs.

Please note that for the purposes of this calculation, annual emissions reductions are calculated using 2021 emissions factors. Emissions factors naturally decrease over time, meaning the GHG reduction associated with each benefit in future years decreases as factors such as passenger vehicles' fuel efficiency improves.

Representation in the Affordable Housing Map and Benefits Calculator

In the Affordable Housing Map and Benefits Calculator itself, we represent these environmental benefits as 'GHG Emission Reductions from Proximity to Transit' and 'GHG Emission Reductions from Proximity to Jobs.' At the property level, each of these values is the annual GHG emission reduction for 2021. At the aggregate level—statewide, county, city, or legislative districts—this figure is the total 2021 emission reductions for all properties in the selected geography.

GLOSSARY

Glossary for the Affordable Housing Map and Benefits Calculator

Affordable Homes – The affordable homes variable denotes the total number of units in the property designated as affordable and excludes all market-rate and managers units.

AB 1550 Low-Income Community – Assembly Bill 1550 built upon the provisions outlined in SB 535 by including a focus on investments in low-income communities and low-income households. AB 1550 defines low-income communities as those census tracts with: (1) median household incomes at or below 80 percent of the statewide median income or (2) median household incomes at or below the threshold designated as low-income by California Department of Housing and Community Development's (HCD) list of State income limits.

Assembly District – The California State Assembly is the lower house of the California State Legislature. The Assembly has 80 members, each representing one district.

California Department of Housing and Community Development (HCD) – HCD is a state-level government agency that oversees a number of programs and allocates loans and grants to preserve and expand affordable housing opportunities and promote strong communities throughout California.

CalEnviro Screen 4.0 – The California Communities Environmental Health Screening Tool (CalEnviro Screen) assesses all census tracts in California to identify which areas are disproportionately burdened by and vulnerable to multiple sources of pollution.

California Housing Finance Agency (CalHFA) – CalHFA is California's affordable housing bank that provides financing and programs that support affordable housing opportunities for low to moderate income households.

Construction Type – The construction type variable identifies whether properties are financed prior to their construction ('New Construction') or as a funding source to rehabilitate an existing property ('Acquisition/Rehabilitation').

Federal Opportunity Zone – An Opportunity Zone is an economically-distressed community where new investments, under certain conditions, may be eligible for preferential tax treatment.

Housing Type – The housing type variable identifies the specific population to be served by the development and is defined by each funding agency. TCAC, for example, has four housing

types—Large Family, Senior, Special Needs, and At-Risk—each with its own defined terms. Senior properties, for example, house tenants either 55 years or 62 years and older. At-Risk refers to projects with affordability restrictions at risk of their compliance period expiring.

Low Income Housing Tax Credits (LIHTC) – tax credits financed by the federal government and administered by state housing authorities like the California Tax Credit Allocation Committee (TCAC) to subsidize acquisition, construction, and rehabilitation of properties for low-income households.

Placed in Service – The placed in service year identifies when a property has been completed and is operating under its regulatory agreement or contract.

Rural – Whether a property is located in a rural census tract is determined by the TCAC/HCD Opportunity Map, which designates all non-metropolitan counties—plus Butte, Shasta, Sutter, and Yuba Counties—and tracts that are eligible for Section 515 funding as rural areas.[66]

Senate District – The California State Senate is the upper house of the California State Legislature. The Senate has 40 members, called senators, each representing one district.

Tax Credit Type – Tax Credit type identifies whether the property is financed using a 4% or 9% Low Income Housing Tax Credit (LIHTC). The LIHTC is designed to subsidize either 30 percent or 70 percent of the low-income unit costs in a project. The 30 percent subsidy, which is known as the 4% tax credit, covers new construction that uses additional subsidies or the acquisition cost of existing buildings. The 70 percent subsidy, or 9% tax credit, supports new construction without any additional Federal subsidies.

TCAC/HCD Opportunity – California's two main affordable housing funding agencies, the Tax Credit Allocation Committee (TCAC) and the Department of Housing and Community Development (HCD), adopted these maps in 2018 to inform policies that incentivize affordable housing for families to be located in higher-resource neighborhoods. Tracts in each regional map are assigned to one of four categories (highest resource; high resource; moderate resource; and low Resource) based on regionally derived scores for 16 evidence-based neighborhood indicators, or to a fifth category (high segregation and poverty) if they are both racially segregated and high-poverty.

[66] California Fair Housing Task Force. 2021. Opportunity Mapping Methodology. Website: https://www.treasurer.ca.gov/ctcac/opportunity/final-opportunity-mapping-methodology.pdf

Total Homes – The total homes variable denotes the total number of units in the property, both affordable and market-rate.

U.S. Congressional District – U.S. Congressional districts are electoral divisions for the purpose of electing members of the United States House of Representatives. There are currently 53 U.S. Congressional Districts in California.

U.S. Department of Agriculture (USDA) – USDA is a federal agency that offers loans, grants and loan guarantees to help support economic development and housing in rural communities.

U.S. Department of Housing and Urban Development (HUD) – a federal agency that supports community development and home ownership, enforces the Fair Housing Act, and oversees a number of programs such as the Community Development Block Grant (CDBG) and the Housing Choice Voucher (HCV) Program to assist low-income and disadvantaged individuals with their housing needs.

Glossary for the Methodology Documentation

At-Risk Properties – At-risk affordable housing are properties that are nearing the end of their affordability restrictions and/or project-based subsidy contract and may convert to market-rate in the next five years.

California Department of Housing and Community Development (HCD) – HCD is a state-level government agency that oversees a number of programs and allocates loans and grants to preserve and expand affordable housing opportunities and promote strong communities throughout California.

California Housing Finance Agency (CalHFA) – CalHFA is California's affordable housing bank that provides financing and programs that support affordable housing opportunities for low to moderate income households.

California Tax Credit Allocation Committee (TCAC) – TCAC is a state-level committee under the California Treasurer's Office that administers the Federal and State Low-Income Housing Tax Credit (LIHTC) Program.

Cost Burden – Cost burden looks at the percentage of income paid for housing by households at different income levels. A home is considered affordable if housing costs absorb no more than 30% of the household's income. A household it cost burdened if they pay more than 30% of their income towards housing.

Fair Market Rent (FMR) – FMRs are limits set by the U.S. Department of Housing and Urban Development (HUD) to determine what rents can be charged in various Section 8 programs and the amount of subsidy that is provided to Section 8 Housing Choice Voucher (HCV) recipients. Limits are set using the U.S. Decennial Census, the American Housing Survey (AHS), gross rents from metropolitan areas and counties, and from the public comment process. These limits can be adjusted based on market conditions within metropolitan areas defined by the Federal Office of Management and Budget (OMB) to accommodate for high-cost areas.

Hybrid Projects – A hybrid project has two components with separate LIHTC applications, a 9% and a 4% application. These can be two components of a single building, two components located on a single parcel, or parcels within ¼ mile of each other. The construction start dates must be within 6 months of each other or completion dates must be within 6 months of each other.

Project-Based Section 8 - Previously known as the Section 8 New Construction and Substantial Rehabilitation Program (Section 8 NC/SR), the project-based section 8 program is administered

by HUD and provided a rental subsidy to building owners who housed low-income tenants. Rents were capped at 30 percent of household income. While HUD phased out the Section 8 NC/SR program in 1983 and replaced it with Section 8 housing vouchers, local agencies are permitted to "project-base" a percentage of their Section 8 Housing Choice Voucher allocation. Also, while no new units are created by this program, some properties still have existing contracts.

Project Rental Assistance Contract (PRAC/202 and PRAC/811) - Project Rental Assistance Contracts (PRAC/202 and PRAC/811) is administered by HUD and provides capital and operating funds for the development and operation of housing for seniors (Section 202) and persons with disabilities (Section 811) with very low incomes. Rents are capped at 30% of household income.

Permanent Supportive Housing – Permanent support housing is long-term, permanent housing for individuals who are homeless or have high service needs.

Project-Based Voucher (PBV) Program – PBVs are provided by public housing agencies through the Housing Choice Voucher (HCV) Program that are tied to a specific property rather than attached to a tenant. The PBV Program partners with developers and service providers to create housing opportunities for special populations such as the homeless, elderly, disabled, and families with mental illness.

Rent Supplement Program – The Rent Supplement program is administered by HUD and gives rental assistance to low-income tenants of privately-owned housing. Eligible tenants pay 30% of the rent or 30% of their household income toward the rent, whichever is greater. No new contracts have been issued since 1973, though some contracts are still active and some previously subsided Rent Supp properties have converted to Section 8 assistance.

Rental Assistance Payments (RAP) - The Rental Assistance Payments (Section 236) program was established by HUD and combined federal mortgage insurance with interest reduction payments to the mortgagee (Section 236 Interest Reduction Payments (IRP)) and additional rental assistance subsidies for low-cost rental housing. The issuance of new contracts has ceased with the introduction of Section 8.

Resyndication – Resyndication is a new allocation of tax credits issued to preserve an existing LIHTC property and finance rehabilitation activity and upgrades.

Section 8 Housing Choice Voucher (HCV) Program – HCVs are funded by HUD and provide low-income renters with a subsidy to help them afford market rentals by paying the difference between what the tenant can afford (30% of their income) and the market rent. Eligibility is determined by the household's annual gross income and family size and the housing subsidy is paid directly to the landlord.

Section 202 Direct Loans – The Section 202 Direct Loans program is administered by HUD and provides federal loans to assist in the development of new or substantially rehabilitated housing to serve the elderly, physically handicapped, developmentally disabled or chronically mentally ill adults.

Section 221(d)(3) Below Market Interest Rate (BMIR) - The Section 221d(3) Below Market Interest Rate (BMIR) program allowed developers to obtain BMIR for charging low rents to middle-income households who could not otherwise qualify for public housing. The program was ultimately replaced by the Section 236 program.

Section 236 Preservation Program - HUD's Section 236 Preservation Program preserves the affordability of rental housing units originally developed through the Section 236 mortgage program.

Section 515 Rural Rental Housing Loan Program – The Section 515 program is administered by the USDA and provides mortgages for affordable rental housing dedicated for very low-, low-, and moderate-income tenants.

Section 514 Farm Labor Housing (FLH) Program - The Section 514 Farm Labor Housing (FLH) program is administered by the USDA and provides loans for the development of farmworker housing.

Severe Cost Burden – Severe cost burden is when housing costs consume more than 50% of household income a household is considered severely cost burdened.