Hawai'i Housing Demand: 2025-2035

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Department of Business, Economic Development and Tourism
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Contents

I. Introduction

In December 2019, the State of Hawaiʻi Department of Business, Economic Development, and Tourism (DBEDT) released a report *Hawaii Housing Demand: 2020 – 2030*, which updated the housing demand projection for the state from 6,470 a year (for the 2015-2025 period) to 3,616 a year (for the period 2020-2030). The downward revision incorporated long-range population projections based on data through 2016 (DBEDT 2045 Series) and then-estimated decreases in Hawaiʻi's 2017 and 2018 resident population.[1]

This report updates DBEDT's housing demand projections through 2035 to incorporate population, household, and housing unit counts from the 2020 U.S. Census Bureau (Census Bureau) decennial census. Housing demand in this study refers to the number of new housing units that consumers (local residents and out-of-state buyers) can afford to purchase or rent under current economic and housing market conditions (i.e., assuming income levels and housing prices remain in the same proportion). As a result, this report may provide guidance for developers or county planners. This report does not address potential or "pent-up" housing demand, which includes households who may desire their own home but cannot afford one under current market conditions. Policy makers seeking to address this issue are directed to the Hawaiʻi Housing Planning Study prepared for the Hawaiʻi Housing Finance and Development Corporation (HHFDC), which includes pent-up demand as part of its housing demand estimates.[2] The HHFDC (2019) study found that the number of additional housing units needed statewide for the period 2020-2025 was 50,156 units, or 10,031 units per year.

Housing demand in this study is estimated under two scenarios: 1) population growth by cohort-component method, and 2) population growth based on historical trend. The cohort-component method utilizes long-run projected trends in fertility, mortality, and net migration for each birth cohort to develop population projections and is used in DBEDT's long-range population and economic projections.[3] Based on DBEDT's analysis, the projected housing demand attributed to long-run population growth during the 2025-2035 period is 2,482 units per year based on population projections using the cohort-component method. If population growth follows historical trend, the projected housing demand for the 2025-2035 period is 4,112 units per year. The average of the two scenarios is 3,297 housing units per year.

Section II describes historical population, household, and housing unit trends, including trends in vacant housing units. Section III describes the estimation of housing demand and Section IV presents the results. Section V concludes.

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[1] The Census Bureau intercensal population and housing unit estimates for the years 2011 through 2019 will be revised in the Fall of 2024. The upcoming revision will take into account differences between the Vintage 2020 population and housing unit estimates and the results of the 2020 Census. See https://www.census.gov/programs-surveys/popest/about/schedule.html

[2] See https://dbedt.hawaii.gov/hhfdc/files/2020/02/State_HHPS2019_Report-FINAL-Dec.-2019-Rev.-02102020.pdf

[3] The 2050 Series of the DBEDT Population and Economic Projections for the State of Hawaii and its four counties (DBEDT 2050 Series) is forthcoming.

II. Population, Household and Housing Unit Trends

Housing demand is driven by net household growth, which is impacted by population as well as other socio-economic factors such as changes in the age distribution of the population, social trends such as marriage and divorce rates, and economic factors such as the cost and availability of housing.[4] Housing demand also includes the demand for vacant housing units, which is a combination of the demand for vacant for-sale properties, the demand for vacant for-rent properties, and the demand for vacant units for other reasons, including but not limited to second and occasional use homes.[5] Figure 1 shows the growth in Hawaiʻi's resident population, housing units, and occupied housing units (households) between 1900 and 2020 based on data from the Census Bureau's decennial census.

Figure 1. Hawaiʻi's Resident Population, Households, and Housing Units, 1900 – 2020
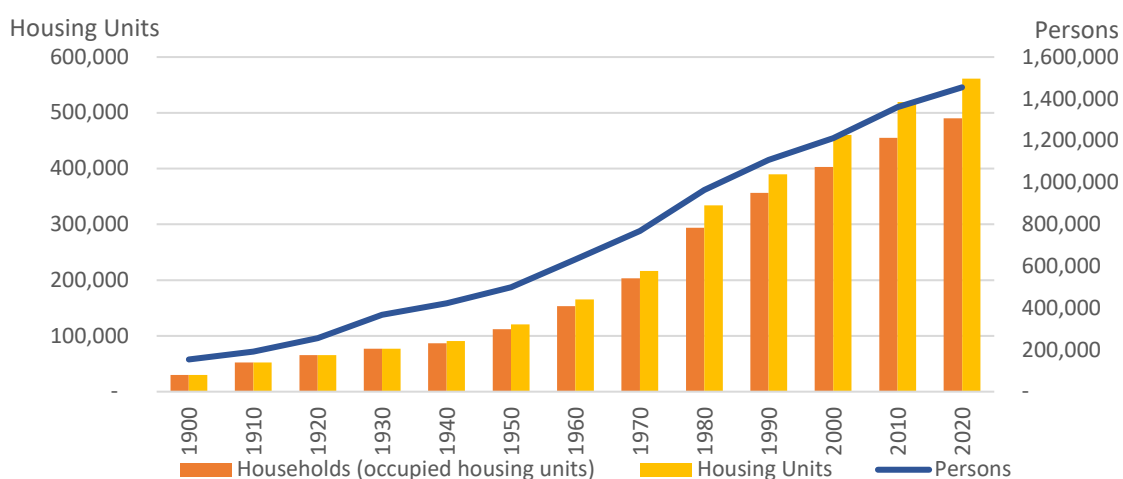
Source: Statistical Abstract of Hawaii (1962), and the State of Hawaii Data Book (1972, 1981, 1985, 2000, 2010, and 2022). Population, household, and housing unit counts are as of April 1, to the extent that data is available and are based on U.S. Census Bureau decennial census counts.

Figure 2 shows the average annual growth rates of population, households, and housing units over ten-year periods between 1900 and 2020. The ten-year average annual growth rates for households and housing units appear to exceed resident population growth rates from the 1940 to 1950 period through the 1990 to 2000 period, with average annual growth in resident

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[4] Households form, for example, as young adults move out of their parents' homes, divorces separate existing households, and new migrants begin residence in the state. Conversely, a reduction in households may occur due to death, the placement of family members into institutional care, marriage, young adults or elderly parents moving back in with their family, and out-of-state migration by residents.

[5] A housing unit is considered vacant if no household considers it their "usual residence" (i.e., no household lives in it most of the time). A vacant unit may be occupied by persons who have a usual residence elsewhere. This does not include barracks, dormitories, transient accommodations, or other quarters not defined as "housing units". See Appendix A for more detail.

population, households, and housing units generally slowing after 1980. Average annual growth rates in population, households, and housing units were similar during the 2000 to 2010 period (approximately 1.2%) and during the 2010 to 2020 period (0.7% growth in population and households, 0.8% growth in housing units).

Figure 2. Ten-year Average Annual Growth Rates for Resident Population, Households, and Housing Units: 1900-1910 through 2010-2020
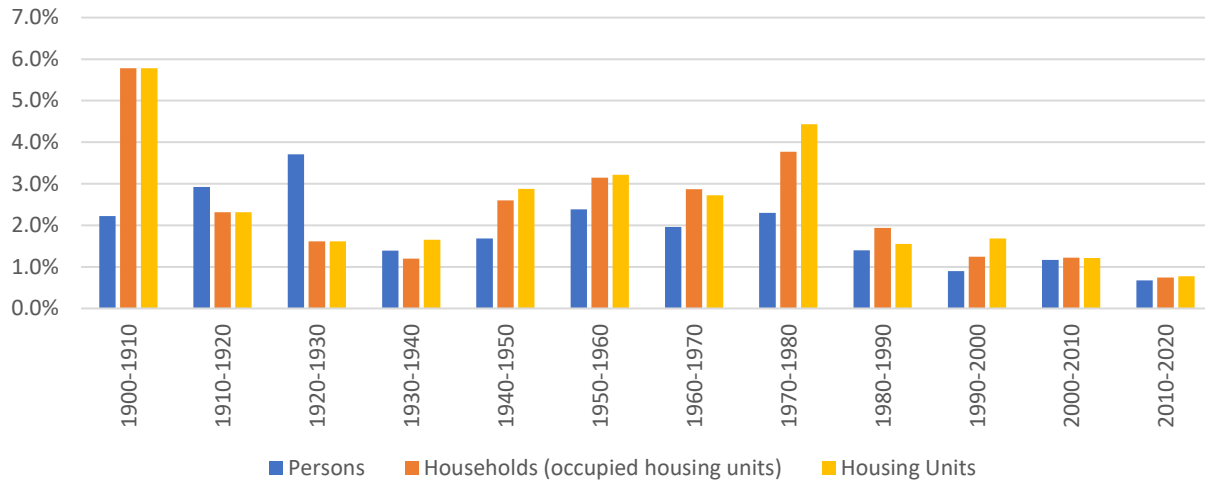
Source: U.S. Census Bureau, Decennial Census. Calculations by DBEDT.

Vacant units as a percentage of all housing units increased significantly between 1970 and 1980 and comprised 12.0% of all housing units in 1980. The percentage of vacant units fell to 8.6% in 1990 but has remained at 12.4% or higher since the year 2000. In 2020, 12.6% of the total housing units in Hawai'i were vacant, compared to a vacancy rate of 9.7% for the United States.

Figure 3. Occupied and Vacant Housing Units and Percentage of Vacant Units, 1960 – 2020
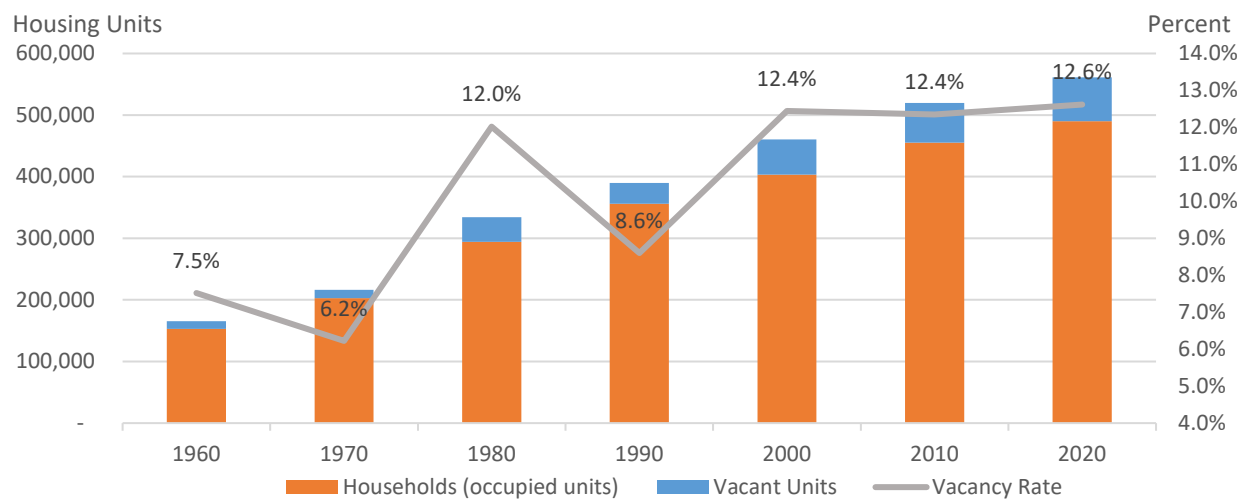
Source: U.S. Census Bureau, Decennial Census. Calculations by DBEDT.

In addition to decennial census counts, vacancy rates by state are estimated annually based on responses to the U.S. Census Bureau's American Community Survey and Current Population Survey/Housing Vacancy Survey (CPS/HVS). Based on CPS/HVS estimates, Hawaiʻi's vacancy rate was 15.0% in 2020. In 2023, Hawaiʻi had the fifth highest vacancy rate (14.8%) among all the states and Washington, D.C., and the highest year-round vacancy rate (14.0%).[6]

The largest category within vacant housing units is units for seasonal, recreational, or occasional use ("vacation homes").[7] The number and percentage of units for seasonal, recreational, or occasional use increased significantly between 1980 and 2010. Between 2010 and 2020, the percentage and number of vacation homes decreased slightly to 5.2% of Hawaiʻi's housing stock or approximately 29,000 housing units.

Figure 4. Number and Percentage of Second or Vacation Homes, 1960 – 2020
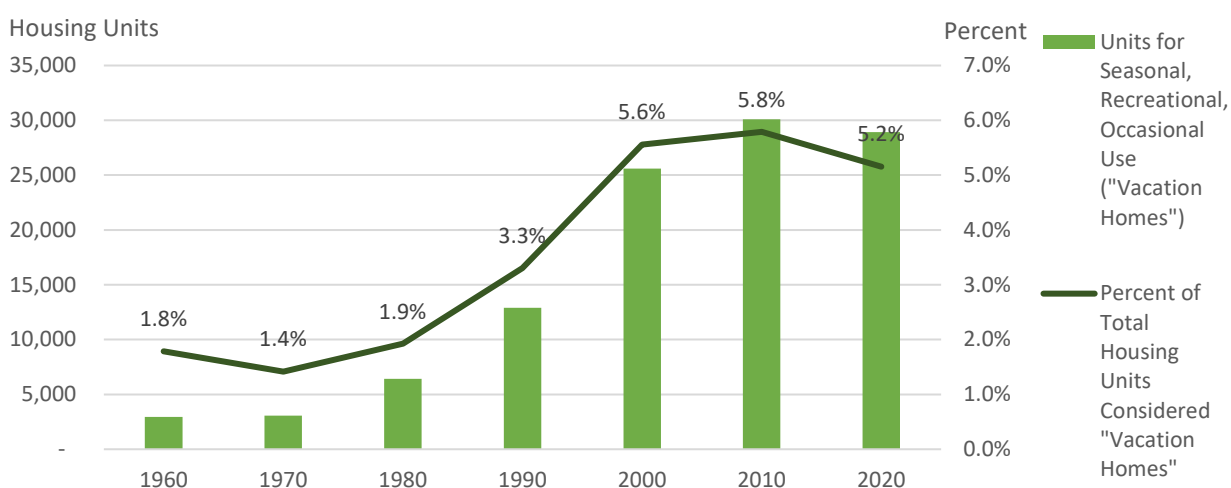
Source: U.S. Census Bureau, Decennial Census.

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[6] U.S. Census Bureau, Current Population Survey/Housing Vacancy Survey, March 12, 2024, Table 5 and Table 5a, accessed March 15, 2024. The year-round vacancy rate is the percentage of year-round housing inventory that is vacant. The year-round vacancy rate (and inventory) does not include housing units that are intended for occupancy only during certain seasons of the year (seasonal housing units).
The Census Bureau has recognized the historical differences between vacancy rates based on data from the Decennial Census and from the CPS/HVS (as well as the ACS). See, for example, "Comparability with Decennial Census Housing Data" in the Historical Current Population Survey/Housing Vacancy Survey (CPS/HVS) Changes section of the U.S. Census Bureau's Housing Vacancies and Homeownership Annual Statistics: 2022; Cresce, Arthur R. (2012) Evaluation of Gross Vacancy Rates From the 2010 Census Versus Current Surveys: Early Findings from Comparisons with the 2010 Census and the 2010 ACS 1-Year Estimates, SEHSD Working Paper Number 2012-07; and Bates, Larry (2012) Understanding Differences in ACS and 2010 Census Information on Occupancy Status – Sampling Frame, American Community Survey Research and Evaluation Program Final Report.
[7] Other categories are vacant units for rent, rented but not occupied, for sale, sold but not occupied, and all other vacants.

County Trends

Hawai'i County, Kauai County, and Maui County have grown in their shares of the state's resident population over time based on decennial census data. Honolulu County's share of the state's population has declined since 1970. In 2020, 69.9% of the state's population resided in Honolulu County compared to Hawai'i County at 13.8%, Maui County at 11.3%, and Kauai County at 5.0%. See Figure 5.

Figure 5. County Shares of Statewide Resident Population, 1960 -2020
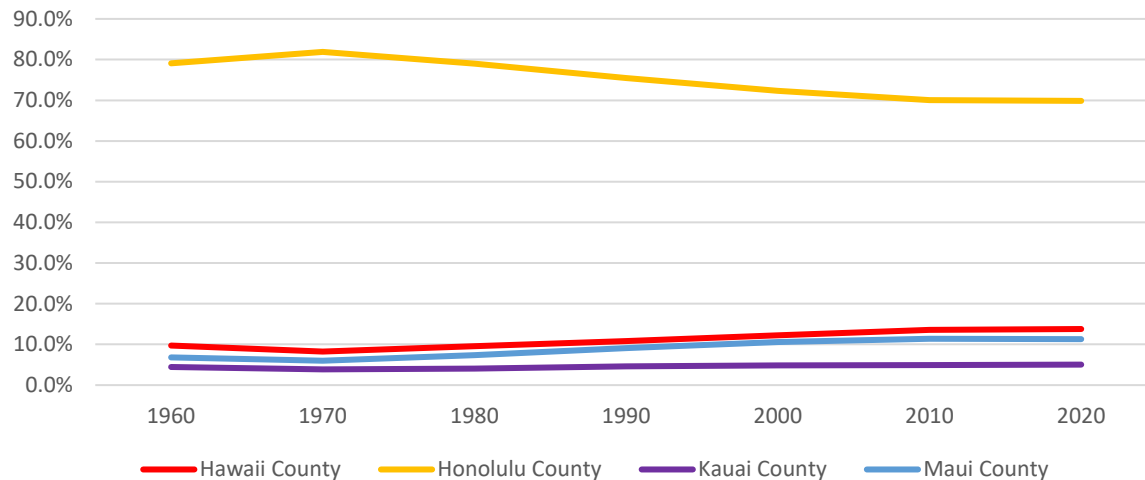
Source: U.S. Census Bureau, Decennial Census. Calculations by DBEDT.

Figures 6.a. through 6.d show the distribution of population, housing units, households (occupied units), and vacant units in 2020. The neighbor island counties had higher shares of housing units than their respective shares of the state population. This is driven by the neighbor island counties having both higher shares of households and higher shares of vacant housing units than Honolulu County. In 2020, Honolulu County had 69.9% of the resident population but only 66.1% of the housing units in the state. While Honolulu County had a slightly smaller share of households (68.6%), it also had a smaller share of the state's vacant housing units (48.4%). Just over half of the state's 70,799 vacant housing units were located in neighbor island counties: Hawai'i County with 15,670 vacant housing units (22.1%), Kauai County with 5,445 units (7.7%), and Maui County with 15,431 units (21.8%).

Figure 6.a. County Shares of Population, 2020
Statewide Resident Population: 1,455,271
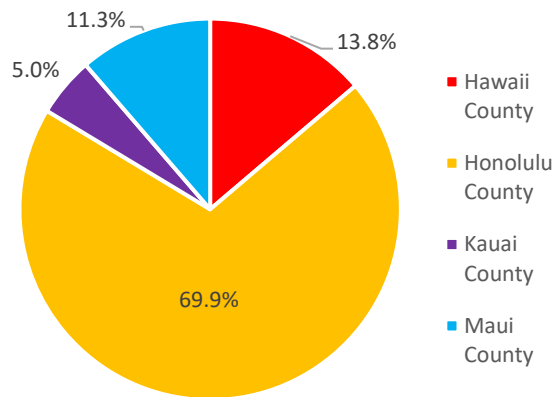
Figure 6.b. County Shares of Housing Units, 2020
Statewide Housing Units: 561,066
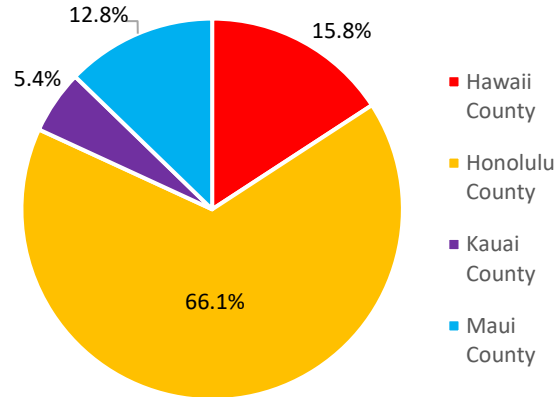
Figure 6.c. County Shares of Households, 2020
Statewide Households: 490,267
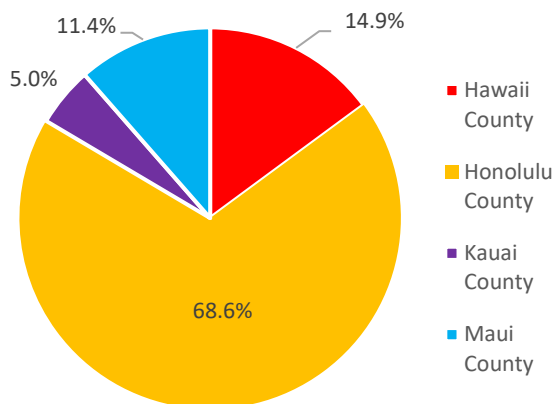
Figure 6.d. County Shares of Vacant Units, 2020
Statewide Vacant Units: 70,799
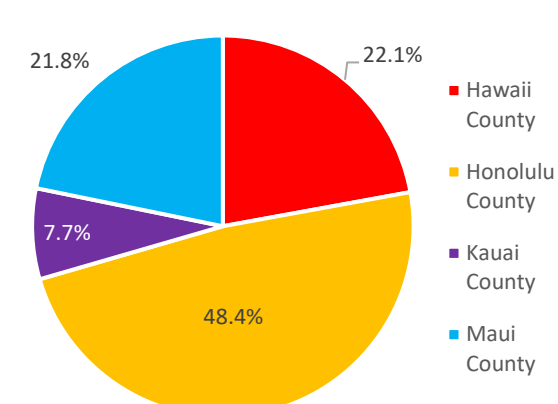
Source: U.S. Census Bureau, Decennial Census. Counts are as of April 1. Calculations by DBEDT.

III. Methodology

This report focuses on the housing demand that is driven by long-run changes in projected state and county population.[8] To this end, an econometric model was developed using historical data

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[8] As indicated earlier, this study does not address potential or "pent-up" demand, nor does it estimate the amount of housing that would be demanded at various prices (e.g., affordable housing) or for various types of units (e.g., single-family vs. multi-unit homes, number of bedrooms, etc.) The Hawaii Housing Planning Study, prepared for HHFDC, provides a discussion regarding the potential or pent-up demand for housing in Hawai'i. DBEDT's report

to estimate the relationship between Hawaiʻi's resident population and the number of housing units over time. Decennial census data on population and housing units for the period 1900 through 2020 were used.[9] While the econometric model assumes that demand for housing units can be estimated based on population, it allows for the relationship between population and housing units to change over time. The model and regression results are described in Appendix B.

Next, state population projections for 2025 through 2035 were used in conjunction with the econometric model to forecast the number of housing units demanded through 2035. Population projections are based on two scenarios: one that utilizes the cohort-component method (Population forecast – cohort-component), and one based on historical trend (Population forecast – historical trend). DBEDT uses the cohort-component method to develop its long-range population and economic projections (DBEDT 2050 Series, forthcoming). This method incorporates long-run projected changes in fertility and mortality for each birth cohort (persons born in a given year) as well as long-run net migration trends. The historical trend population forecast is based on a regression model of population over time; the model and regression results are discussed in Appendix B.

Figure 7 illustrates Hawaiʻi's actual resident population through 2020 as well as the forecasted population growth through 2035 under both scenarios.

Figure 7. Hawaiʻi Resident Population and Forecasted Population, 1900 - 2035
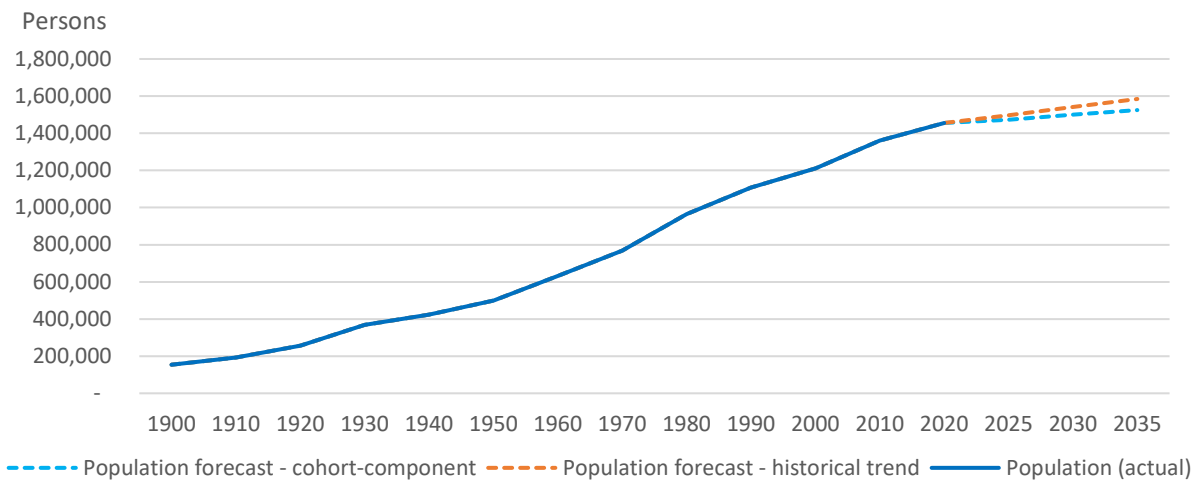
Source: U.S. Census Bureau and DBEDT calculations.

Defining and Measuring Housing Affordability in the State of Hawaiʻi examines the issue of housing affordability in Hawaiʻi, including the factors influencing housing affordability.
https://dbedt.hawaii.gov/economic/files/2024/02/Housing-Affordability-February-2024.pdf

[9] Since the 2011 through 2019 intercensal population and housing unit data are still subject to revision based on the results of the 2020 decennial census, this study uses the decennial census housing and population counts as the basis for its estimates.

Once housing unit projections were calculated using the population projections and the model of housing demand, a statewide historical vacancy rate of 12.6% was assumed to calculate the statewide demand for vacant housing units. As shown earlier in Figure 3, the statewide vacancy rate has been fairly stable across the last three decennial censuses, at 12.4% in 2000 and 2010 and 12.6% in 2020. It is assumed, for the purposes of this analysis, that the statewide vacancy rate will remain approximately 12.6% through 2035. The projected demand for occupied housing units is the difference between the projected housing units and the projected vacant units.

Finally, statewide projections of housing units are allocated to the counties based on historical county shares of households (occupied units) and vacant units, as well as forecasted county population trends. Projected neighbor island county households are based on their historical share of statewide households, adjusted to reflect projected county-level growth in their share of the state's population. It is assumed that each county's share of statewide vacant units through 2035 will remain the same as their share of vacant units in 2020.

IV. Results

Population projections for 2025 and 2035 under the two population growth scenarios are presented in Table 1. Under the model that projects population growth using the cohort-component method, the average population growth in the years 2025 through 2035 is 0.35% per year. Average population growth using the model where population is projected to follow historical trend is 0.57% per year.

Table 1. Statewide Population Projections, 2025 - 2035

Scenario	2025	2035	2025-2035 Average Annual Growth
Population based on cohort-component method	1,472,258	1,524,878	0.35%
Population based on historical trend	1,497,463	1,584,621	0.57%

Source: DBEDT.

Table 2 presents actual housing units based on the 2020 decennial census housing unit counts compared to the units projected under each population growth scenario in 2025 and 2035. The housing units needed between 2025 and 2035 are calculated by subtracting the projected housing units in 2035 from the projected housing units in 2025. Based on this analysis, the housing units needed over the 2025-2035 period based on population projections using the cohort-component method is 24,823 units. Using the population projections based on historical trend, the housing units needed for this period will be 41,118 units. The average of the two scenarios is 32,970 housing units needed between 2025 and 2035.

Table 2. Actual (2020) and Projected (2025, 2035) Statewide Housing Demand

Scenario/Housing Category	2020 (Actual)	2025	2035	2025-2035 Additional Units
Population based on cohort-component method				
Total housing units demanded	561,066	572,034	596,857	24,823
Demand for household growth	490,267	499,958	521,653	21,696
Demand for vacant units	70,799	72,076	75,204	3,128
Annual average growth rate in housing unit demand (2025-2035)				0.43%
Population based on historical trend				
Total housing units demanded	561,066	583,924	625,042	41,118
Demand for household growth	490,267	510,350	546,287	35,937
Demand for vacant units	70,799	73,574	78,755	5,181
Annual average growth rate in housing unit demand (2025-2035)				0.68%
Average				
Total housing units demanded	561,066	577,979	610,950	32,970
Demand for household growth	490,267	505,154	533,970	28,816
Demand for vacant units	70,799	72,825	76,980	4,154
Annual average growth rate in housing unit demand (2025-2035)				0.56%

Source: DBEDT.

The 2025-2035 average annual growth rate in housing units under the population projections using the cohort-component method is 0.43%. The average annual growth rate of housing units under the population projections based on historical trend is 0.68%. The average of the two scenarios has an average annual growth rate in housing units of 0.56% between 2025 and 2035. Note that since the share of vacant units among total housing units is assumed to remain the same (12.6%) over the 2025-2035 period, demand for vacant and occupied housing units (households) are assumed to grow at the same rate as overall housing unit demand.

Compared to prior DBEDT projections, the projected share of vacant units (12.6%) in this study is smaller than the shares projected in prior studies. For example, DBEDT (2019) projected demand for vacant units between 2020 and 2030 would be 34.7% of the total demand for housing.[10] The difference in the projected share of vacant units is largely due to updated data on vacant units indicating lower growth in vacant units after 2000 and that vacancy rates have been relatively stable (see Figure 3).

If the share of vacation homes remains the same as in 2020 (5.2% of total housing units), this implies that 1,291 of the housing units demanded under the population projections using the cohort-component method will be for second or vacation homes (5.2% x 24,823 total housing

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[10] Based on average demand for vacant units divided by average total demand for housing. DBEDT (2019). *Hawaii Housing Demand: 2020-2030*. https://files.hawaii.gov/dbedt/economic/reports/housing-demand-2019.pdf

units). Under the population projections based on historical trend, the units demanded for vacation or second homes over the 2025-2035 period would be 2,138 units (5.2% x 41,118 total housing units). Under the average of the two scenarios, the units demanded for vacation or second homes would be 1,714 units (5.2% x 32,970 total housing units).

Table 3 presents housing demand by county and category over the 2025-2035 period. Statewide housing demand was allocated to the county level based on historical county shares of statewide households and vacant units, as well as forecasted county population trends.

Table 3. Additional Housing Demand by County and Type, 2025-2035

Scenario/Housing Category	State	Honolulu	Hawaiʻi	Maui	Kauai
Population based on cohort-component method					
Total housing units	24,823	13,476	5,313	4,067	1,968
Occupied Units (Households)	21,696	11,962	4,620	3,385	1,728
Vacant units	3,128	1,513	692	682	241
Population based on historical trend					
Total housing units	41,118	23,999	8,018	6,209	2,891
Occupied Units (Households)	35,937	21,493	6,871	5,080	2,492
Vacant units	5,181	2,507	1,147	1,129	398
Average					
Total housing units	32,970	18,737	6,665	5,138	2,429
Occupied Units (Households)	28,816	16,728	5,746	4,233	2,110
Vacant units	4,154	2,010	919	905	319

Source: DBEDT.

If population follows the projections based on the cohort-component method, Honolulu County will need 13,476 units over the 2025-2035 period, Hawaiʻi County will need 5,313 units, Maui County will need 4,067 units, and Kauai County will need 1,968 units. If population follows the projections based on historical trend, Honolulu County will need as many as 23,999 units over the 2025-2035 period, Hawaiʻi County will need 8,018 units, Maui County will need 6,209 units, and Kauai County will need 2,891 units. The average of the two scenarios is 18,737 housing units needed for Honolulu County, 6,665 units needed for Hawaii County, 5,138 units needed for Maui County, and 2,429 units needed for Kauai County.[11]

Figures 8a and 8b present the shares of housing units by county projected for the year 2035 under each population growth scenario. As shown below, the distribution of housing units is the same across both scenarios, with 64.9% of housing units being in Honolulu County, followed by 16.4% in Hawaiʻi County, 13.0% in Maui County, and 5.6% in Kauai County. Compared to 2020, Hawaiʻi County has a slightly larger share of total housing units in 2035 (16.4% compared to 15.8%) while Honolulu County has a slightly smaller share (64.9% compared to 66.1%).

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[11] Maui population projections were adjusted to reflect the impacts of the August 2023 wildfires. To the extent that the housing units lost during the fires have not been rebuilt by 2025, those units would need to be added to housing unit demand for the 2025-2035 period.

Figure 8.a. County Shares of Housing Units, 2035
Statewide Housing Units: 596,857
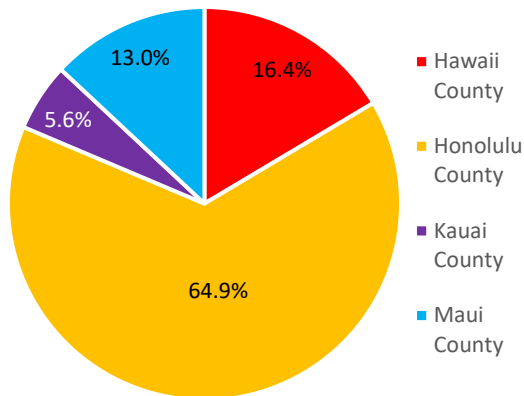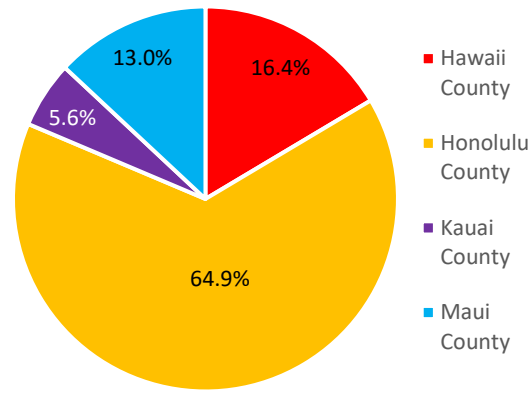Population based on cohort-component method

Figure 8.b. County Shares of Housing Units, 2035
Statewide Housing Units: 625,042
Population based on historical trend

Source: DBEDT.

V. Conclusion

This report estimates long-run housing demand under two population projection scenarios: one in which population growth is projected based on the cohort-component method, and another in which population growth is projected based on historical trend. Projected housing demand for the state over the 2025-2035 period is 24,823 housing units based on population growth using the cohort-component method. If population growth follows historical trend, the projected housing demand for the 2025-2035 period is 41,118 housing units. The average of the two scenarios is 32,970 housing units demanded between 2025 and 2035.

There are caveats to these estimates. First, as has been mentioned throughout this report, the focus of this study is to estimate the housing demand that is driven by anticipated long-run changes in Hawaiʻi's population. It does not address the impacts of changes in policy or market conditions that may increase or decrease demand for housing and assumes that income levels and housing costs remain in the same proportion. Second, given that the intercensal population and housing data for 2011-2019 has not yet been revised following the 2020 decennial census, this study relies on the population and housing data from the Census Bureau decennial censuses. As such, this study does not explicitly incorporate more granular annual data, including intercensal population estimates for 2021, 2022, and 2023.[12] Decennial census data is appropriate, however, to the extent that it captures long-run trends in population and housing.

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[12] DBEDT is aware that recent intercensal population and housing unit estimates for the years 2021, 2022, and 2023 have shown declines in the state's population. DBEDT notes that these estimates may be revised following the results of the 2030 decennial census.

Appendix A: Definitions

Housing Unit: A house, an apartment, a group of rooms, or a single room occupied or intended for occupancy as separate living quarters. Separate living quarters are those in which the occupants do not live and eat with other persons in the structure and which have direct access from the outside of the building or through a common hall. The housing unit inventory does not include dormitories, bunkhouses, and barracks; quarters in predominantly transient hotel or motels unless occupied by persons who consider the hotel their usual place of residence; quarters in institutions, general hospitals and military installations unless occupied by staff or resident employees with separate living arrangements.

Occupied Housing Unit: A housing unit that is the usual place of residence of the person or group of persons living in it on Census Day, or if the occupants are only temporarily absent (e.g., on vacation or business trip). The count of occupied housing units is the same as the count of households. A "usual place of residence" is the place where a person lives or sleeps most of the time.

Vacant Housing Unit: A housing unit with no one living in it on Census Day, unless the occupants are only temporarily absent and will be returning. Housing units that are temporarily occupied on Census Day entirely by persons who have a usual residence elsewhere are considered vacant. Vacant housing units include vacant units for rent; vacant units rented but not occupied; vacant units for sale only; vacant units sold but not occupied; vacant units for seasonal, recreational, or occasional use; and vacant units for other use. For example, a vacant unit may be held off the market for occasional or seasonal use (e.g., as a second home) or as a short-term vacation rental unit. A unit may also be vacant due to foreclosure or other legal proceedings, for personal or family reasons, or as the unit is being prepared for rent/sale, etc.

Gross Vacancy Rate: The proportion of total housing inventory that is vacant. The gross vacancy rate is defined as all vacant units divided by all housing units (occupied and vacant).

Year-round Vacant Units: Year-round units are intended for occupancy at any time of year, though they may not be in use all year round. Year-round units that are temporarily occupied by persons with a usual residence elsewhere are included as year-round vacant units.

Seasonal Vacant Units: Housing units intended for occupancy only during certain seasons of the year.

Sources: Based on the descriptions in U.S. Census Bureau, 2020 Census Demographic and Housing Characteristics File (DHC), Census of Population and Housing, Technical Documentation, April 2023 (https://www2.census.gov/programs-surveys/decennial/2020/technical-documentation/complete-tech-docs/demographic-and-housing-characteristics-file-and-demographic-profile/2020census-demographic-and-housing-characteristics-file-and-demographic-profile-techdoc.pdf) and U.S. Census Bureau Housing Vacancies and Homeownership, Definitions, and U.S. Census Bureau Current Population Survey/Housing Vacancy Survey, March 15, 2023. https://www.census.gov/housing/hvs/definitions.pdf

Appendix B: Econometric Models and Performance

Estimating the historical relationship between Hawai'i's population and housing units over time

An econometric model was used to estimate the level of housing demand for the state based on population growth over time. Hawai'i housing unit and population data for the years 1900 through 2020 from the Census Bureau decennial census were used for the analysis.

The results and performance of the regression model are described below. The dependent variable is the number of housing units (hu). The model allows for the relationship between population and housing units to change over time where pop1 is the interaction between population and a dummy variable (d1) equal to one for the years 1900 through 1940 (and zero otherwise), pop2 is the interaction between population and a dummy variable (d2) equal to one for the years 1950 through 1970 (and zero otherwise), and pop3 is the interaction between population and a dummy variable (d3) equal to one for the years after 1970 (and zero otherwise). The model also allows for changes in the level of housing units to vary across certain time periods through the inclusion of the dummy variables d1 and d2.

```
. regress hu pop1 pop2 pop3 d1 d2

      Source |       SS           df       MS      Number of obs   =        13
-------------+----------------------------------   F(5, 7)         =   1405.45
       Model |  4.3963e+11          5  8.7927e+10   Prob > F        =    0.0000
    Residual |   437926785          7  62560969.3   R-squared       =    0.9990
-------------+----------------------------------   Adj R-squared   =    0.9983
       Total |  4.4007e+11         12  3.6673e+10   Root MSE        =    7909.5


------------------------------------------------------------------------------
          hu | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
        pop1 |   .1963979   .0345552     5.68   0.001     .1146879    .2781078
        pop2 |   .3571122   .0416182     8.58   0.000     .2587009    .4555235
        pop3 |   .4717559   .0202355    23.31   0.000     .4239066    .5196051
          d1 |   130913.5   26965.68     4.85   0.002     67149.76    194677.2
          d2 |   63767.44   36584.28     1.74   0.125    -22740.64    150275.5
       _cons |  -122512.7    24939.5    -4.91   0.002    -181485.2   -63540.14
------------------------------------------------------------------------------
```

Predicted or "fitted" values for the number of housing units can be calculated using the coefficient estimates. Figure B.1 compares the actual number of housing units during the period 1900 to 2020 with the predicted number of housing units based on the model.

Figure B.1 Actual Housing Units and Predicted Housing Units Based on Model of Housing Demand Between 1900 - 2020
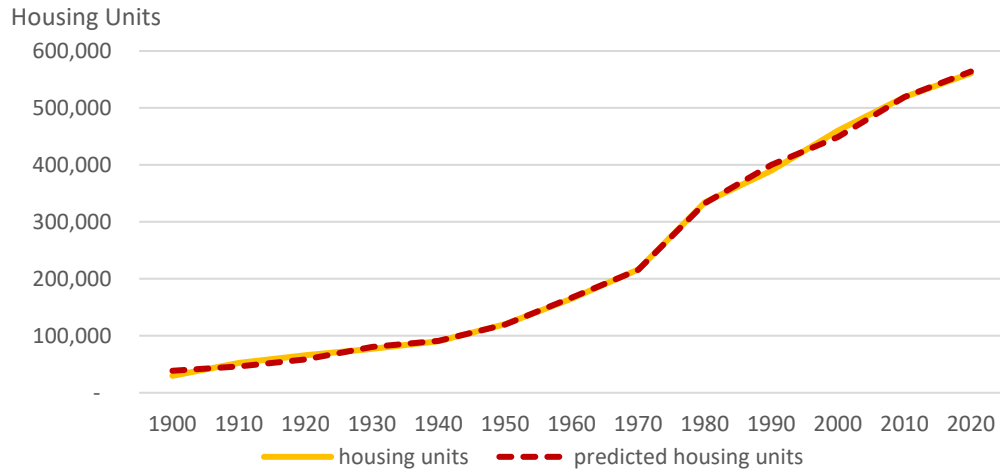
Projecting population based on historical trend

To develop population estimates based on historical trend, decennial census population counts for the period 1900 through 2020 were regressed on a linear annual trend variable (where 1900 = 0 and 2020 = 12) and a series of dummy variables to capture differences in trends over different periods of time. Variable d1 is a dummy variable equal to one for the years 1900 through 1930 (and zero otherwise), d2 is a dummy variable equal to one for the years 1940 and 1950 (and zero otherwise), d3 is a dummy variable equal to one for the years 1960 and 1970 (and zero otherwise), and d4 is a dummy variable equal to one for the years 2010 and 2020 (and zero otherwise). The results are presented below.

```
. regress population year_n d1 d2 d3 d4

      Source |       SS           df       MS       Number of obs   =        13
-------------+----------------------------------   F(5, 7)         =    502.41
       Model |  2.4810e+12         5  4.9620e+11   Prob > F        =    0.0000
    Residual |  6.9134e+09         7   987633887   R-squared       =    0.9972
-------------+----------------------------------   Adj R-squared   =    0.9952
       Total |  2.4879e+12        12  2.0732e+11   Root MSE        =     31427

------------------------------------------------------------------------------
  population | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
      year_n |   88728.18   10779.25     8.23   0.000      63239.3    114217.1
          d1 |  -186843.7   84332.27    -2.22   0.062    -386257.8    12570.46
          d2 |  -234260.2   56355.31    -4.16   0.004    -367519.3   -101001.1
          d3 |  -172332.1   39360.25    -4.38   0.003    -265404.3   -79259.85
          d4 |   91146.56   39360.25     2.32   0.054    -1925.653    184218.8
       _cons |   296265.4    98695.4     3.00   0.020     62887.88    529642.9
------------------------------------------------------------------------------
```

Figure B.2 compares the actual population during the period 1900 to 2020 with the predicted population based on the model.

Figure B.2 Actual Population and Predicted Population Based on Regression Model, 1900 - 2020
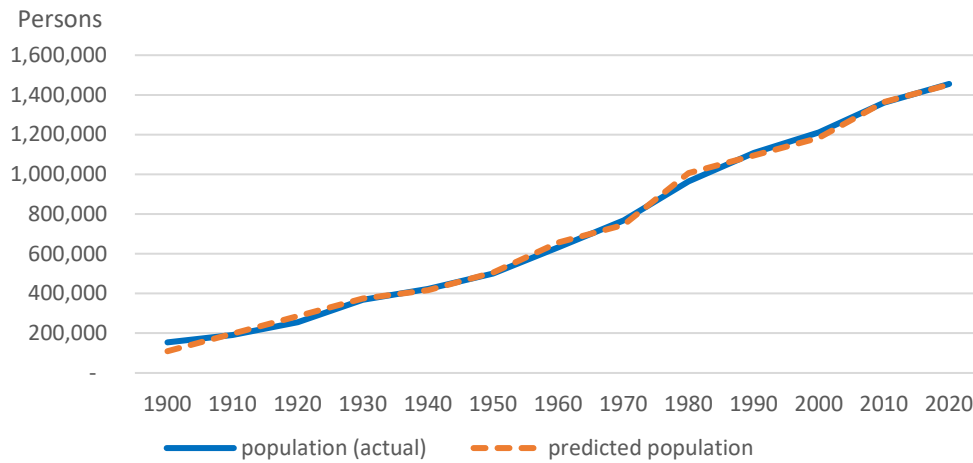
Appendix C: Historical Data - Statewide

Year	Resident Population	Number of Housing Units	Number of Households	Population to Housing Unit Ratio	Population to Household Ratio	Number of Vacant Units	Vacancy Rate
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
				(2)/(3)	(2)/(4)	(3) - (4)	(7)/(3)
1900	154,001	29,763	29,763	5.2	5.2	-	-
1910	191,874	52,219	52,219	3.7	3.7	-	-
1920	255,881	65,670	65,670	3.9	3.9	-	-
1930	368,300	77,070	77,070	4.8	4.8	-	-
1940	422,770	90,830	86,855	4.7	4.9	3,975	4.4%
1950	499,794	120,606	112,290	4.1	4.5	8,316	6.9%
1960	632,772	165,506	153,064	3.8	4.1	12,442	7.5%
1970	768,561	216,568	203,088	3.5	3.8	13,480	6.2%
1980	964,691	334,235	294,052	2.9	3.3	40,183	12.0%
1990	1,108,229	389,810	356,267	2.8	3.1	33,543	8.6%
2000	1,211,537	460,542	403,240	2.6	3.0	57,302	12.4%
2010	1,360,301	519,508	455,338	2.6	3.0	64,170	12.4%
2020	1,455,271	561,066	490,267	2.6	3.0	70,799	12.6%

Sources: Statistical Abstract of Hawaii (1962); State of Hawaii Data Book (1972, 1981, 1985, 2000, 2010, 2022); U.S. Census Bureau, Decennial Census. Calculations by DBEDT. Population, household, and housing unit counts are as of April 1, to the extent that data is available.