Independent Statistics & Analysis
U.S. Energy Information Administration

Residential Energy Consumption Survey (RECS)

2020 Household Characteristics Technical Documentation Brief

March 2022

Independent Statistics & Analysis
www.eia.gov

U.S. Department of Energy
Washington, DC 20585

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Overview and History of RECS

The Residential Energy Consumption Survey (RECS) is a periodic study conducted by the U.S. Energy Information Administration (EIA) that provides detailed information about energy usage in U.S. homes. RECS is a multi-year effort consisting of a Household Survey phase, data collection from household energy suppliers, and end-use consumption and expenditures estimation. The 2020 RECS is the 15th iteration of the study.

The Household Survey, a voluntary survey, collects data on energy-related characteristics and usage patterns of a national and sub-national (e.g., states) representative sample of housing units. The Energy Supplier Survey (ESS), a mandatory data collection, collects data on how much electricity, natural gas, propane/LPG, and fuel oil/kerosene were consumed in the sampled housing units during the reference year. The ESS also collects data on actual dollar amounts spent on these energy sources. EIA uses models (energy engineering-based models in the 2015 and 2020 survey) to produce consumption and expenditures estimates for heating, cooling, refrigeration, and other end uses in all housing units occupied as a primary residence in the United States using the data collected from the Household Survey and ESS. Wood-use estimates are also included as part of RECS.

The scope and purpose of RECS differ slightly from similar EIA products that report *residential* energy data. RECS samples homes occupied as a primary residence, which excludes secondary homes, vacant homes, military barracks, and common areas in apartment buildings. As a result, RECS estimates do not represent sector-level totals defined in other EIA products, but they are best suited for comparison across different characteristics of homes within the residential sector.

This technical documentation brief will provide information on survey processes and methodology utilized for the 2020 RECS Household Survey. A more detailed technical summary will be released with the forthcoming public microdata file. The 2020 RECS Household Survey was conducted in collaboration with IMG-Crown and RTI International.

Survey Design Elements and Changes

- **The target population for the RECS is all occupied housing units in the 50 states and the District of Columbia (DC) that are used as primary residences.** Vacant homes, seasonal housing units, and group quarters, such as dormitories, nursing homes, prisons, and military barracks are excluded. Housing units located on military installations are included.
- **The 2020 RECS sample was designed to meet precision requirements on energy consumption for all 50 states and DC, with an expected yield of 18,000 to 20,000 completed RECS questionnaires from sampled households.** This is the first time in the program's history that estimates will be available for all 50 states and DC. The larger responding sample size also yields more precise estimates for key topics and for emerging technologies such as electric vehicles.
- **Housing units for the 2020 RECS were selected using an Address Based Sample (ABS).** The frame for this sample was a list of residential addresses, based on the U.S. Postal Service's Computerized Delivery Sequence file of active mail delivery points. The frame information was enhanced with supplemental data from the Decennial Census, the American Community Survey (ACS), and other sources to enable stratification of the frame for better statistical efficiency and representation of

the population of eligible housing units. Non-residential addresses were removed from the frame, and procedures were implemented to account for special situations, such as accounting for non-deliverable and drop-point addresses.

- **The 2020 RECS introduced a completely self-administered design via web and paper questionnaire.** Prior to the 2020 RECS, all iterations of the study were conducted either through in-person interviews with trained interviewers at the sampled households, or with a combination of in-person and self-administered modes. By eliminating interviewing staff for the 2020 RECS, the program was able to implement a number of other innovations, including increasing the sample size and moving to an unclustered sample design.
- **New questions were added on emerging technologies and usage behavior, and questionnaire changes were made in response to the COVID-19 pandemic.** The 2020 RECS added questions about solar capacity and installation, electric vehicle ownership and charging behavior, and use of smart speakers to account for emerging technologies. Just prior to data collection, in response to the COVID-19 pandemic, questions were added about regular telework or work from home, and whether anyone in the household was receiving K-12 distance learning or enrolled in online college courses.
- **A total of 18,496 respondents completed the survey, with 73% responding via web questionnaire and 27% responding via paper questionnaire. The total unweighted response rate (AAPOR 3) was 39%, and the total weighted response rate was 38%.** Household survey data collection was conducted in two waves; the first wave was fielded September to November 2020, and the second wave was fielded January to April 2021.
- **All data underwent a series of quality control checks and edits to validate the sampled addresses responded to the survey and to identify and resolve data inconsistencies.** This process included identifying outliers to numeric items, identifying and resolving logical inconsistencies, and recoding write-in responses into established response categories.
- **To address item nonresponse, a hot-deck imputation method was used for the 2020 RECS.** In this method, a *recipient* case that has a missing value for the item being imputed is matched with a similar *donor* case that has a response. The donor's value for that item is used to replace the missing value for the recipient case. About 250 variables were imputed, with a median imputation rate of 2.9%.
- **New approach for housing unit control totals in weighting**. Weighting adjustments were implemented to ensure the responding sample was representative of housing units at the U.S., region, division, and state levels. These weighting adjustments included ineligibility, nonresponse, and poststratification. For poststratification, EIA used a combination of 2020 Decenial Census counts and 2019 American Coummunity Survey (ACS) estimates to calculate control totals because 2020 ACS one-year data products were not published.
- **The 2020 RECS sample utilized the Jackknife Repeated Replication method for variance estimation.** Each RECS estimate has a corresponding Relative Standard Error (RSE). RSEs were calculated using replicate weights, which were determined using the Jackknife method for the 2020 RECS. RSEs are shown as a separate tab in each published Excel table. Estimates with a corresponding RSE of "0.00" are indicative of a variable used as a control total in poststratification.
- **EIA conducted comprehensive nonresponse bias analysis.** Based on the results from the nonresponse bias analysis, EIA identified no major concerns with the data quality of key 2020 RECS estimates, indicating that the final weighted 2020 RECS estimates are not statistically or practically different from the target population.