

B. COLLECTING INFORMATION BY STATISTICAL METHODS

B-1. Description of the Potential Respondent Universe

The 2007 CBECS will collect energy consumption data for calendar year 2007. The universe of potential respondents (commercial buildings) is composed of all nonresidential buildings in the United States, with the following exceptions:

- All buildings that are 1,000 square feet or smaller;
- Commercial buildings on military bases, except for military hospital complexes or educational campuses;
- Buildings having restricted access for national-security reasons;
- Commercial buildings on industrial sites ;
- Manufacturing/Industrial buildings;
- Foreign embassies ;
- Mobile homes used for commercial activity, unless permanently affixed to a foundation;
- Farm buildings;
- Apartment buildings that contain commercial establishments but for which one-half or more of the floorspace is committed to residential usage;
- Single-family detached dwellings that are primarily residential but have some commercial activity; and
- Parking garages.

There is no comprehensive list available of the universe of commercial buildings in the United States; and it would be prohibitively expensive to construct such a list, therefore, a multistage area probability sample design will be used along with a supplemental sample from lists of Federal government buildings, 4-year colleges and universities, hospitals, large buildings, and airports.

A sample of buildings will be selected from the area sample and the supplemental lists. The results of the 2003 CBECS yielded an estimate of the total universe of in-scope commercial buildings of 4.9 million. This estimate excludes all buildings in the above categories.

The 2007 CBECS sample will consist of approximately 8,275 buildings (including strip malls) from the area and supplemental list frames, and 1,180 mall establishments subsampled from within the strip malls. Frame updating and sample selection will be completed by the first week in January, 2008. Based on previous CBECS cycles, it is estimated that these 8,275 buildings will yield approximately 5,625 completed building interviews, and the 1,180 establishments will yield approximately 875 completed establishment interviews. The questionnaire and interviewing procedures for the 2007 CBECS are designed so that only very few buildings will be determined to be out-of-scope after the interview has been completed. The vast majority of the sampled buildings that are out-of-scope buildings will be detected at the start of the interview.

B-2. The Sampling Methodology and Estimation Procedures

Sampling Methodology

The 2007 CBECS design provides estimates of baseline energy consumption and related building characteristics for the universe of commercial buildings in the United States. The survey results will be presented at the national level, the four Census regions, and in instances where the data allows, at the Census division level, as well as by other characteristics such as climate zone, building type, total square footage, number of floors, and year constructed. The top priority levels of aggregation are the National and Census-region estimates.

Similar aggregations of data were produced from the 1979, 1983, 1986, 1989, 1992, 1995, 1999 and 2003 CBECS. For the 2003 CBECS, the sample of 5,215 completed building interviews resulted in a relative standard error (RSE) of approximately 4 percent for national estimates of total energy consumption. At the regional level, energy-consumption RSEs were between 5 and 11 percent, depending on the region. For energy expenditures at the national and regional levels, the RSEs were similar to the RSEs for total consumption (See Tables C3A-C6A: Consumption and Expenditures RSE Tables:

http://www.eia.doe.gov/emeu/cbecs/cbecs2003/detailed_tables_2003/2003rsetables.html)

Like previous CBECS, there are two parts to this sample design, a multistage area probability sample and a supplemental sample of special buildings and new construction.

Multistage Area Probability Frame

The 2007 CBECS is based on a sample design that was new for the 2003 CBECS. Previous CBECS were based on a 1986 sample design that was updated for new construction for each subsequent survey cycle. The general approach of the multistage area probability sample design is to sample and subsample successively smaller geographic areas until it is feasible to list all commercial buildings in the selected areas.

Primary Sampling Unit (PSU): In the multistage area sample portion of the 2007 CBECS design, the approximate 3,100 counties and independent cities in the 50 States and the District of Columbia are grouped into 687 PSUs. The boundaries of these PSUs are contiguous with the boundaries of counties, and independent cities. Of the 687 PSUs in the frame, 108 are selected for the sample PSUs.

The PSUs in the frame are grouped into 64 strata that are relatively homogeneous based on geographic characteristics such as similar climate and topography. These strata are designed not for estimation purposes, but as representative homogeneous groupings from which PSUs are selected. Because of this rationale, a given stratum may include geographic areas that are not contiguous.

Twenty of the 64 strata contained only one PSU and were sampled with certainty. The remaining 44 strata contained multiple PSUs. In each of the remaining 44 strata, two PSUs are selected with probabilities proportional to a measure of size that relates to commercial activity. This provides 88 noncertainty PSUs and 20 certainty PSUs.

Secondary Sampling Unit (SSU): The next step in the multistage area sampling procedure consists of selecting subareas within each sampled PSU. Of the 108 sample PSUs, 731 SSUs are in the frame. Five hundred eleven of these SSUs are in the main sample and 220 are in a reserve sample to be used only if one of the main SSUs has no buildings or if there is a shortage of listed buildings at the PSU level.

The boundaries of the SSUs coincide with those of the Census tracts available from the Bureau of the Census. Five hundred eleven SSUs are selected within the 108 PSUs.

Buildings: The final step consists of selecting buildings within each sampled SSU. A field survey was conducted in each segment that produced a listing of all commercial buildings by size and type. Buildings are selected for inclusion in the sample from these listings, with the sampling rates varying by the type of SSU and then varying within each SSU by the size and type of the building.

Update for New Construction

The area frame will be updated to reflect buildings constructed since 2003 using the United States Postal Service's Delivery Sequence File (DSF), which is a list of mail delivery points in the U.S. This list will be manipulated to represent building-level data and subsequently merged with the existing area frame to identify buildings that were not on the file in 2003. For a few areas in which the DSF has known limitations, the F.W. Dodge list of new construction projects (compiled by McGraw Hill) will be used instead.

List Frame of Special Buildings

It is desirable to sample large buildings at a higher rate than small buildings because of the relatively large amount of energy that is consumed in large buildings. However, the area sampling procedure cannot provide an optimally efficient mix of large and small buildings unless an exceedingly large number of buildings are listed in order to guarantee that a sufficient number of very large buildings would be available for sampling.

To compensate for this inefficiency of the area sample, special lists of government buildings, schools, hospitals, and other large buildings are prepared for the sample PSUs. To complete the full 2007 sample, buildings will be sampled from these lists and then combined with those selected by the area sampling procedure.

The list frame consists of: U.S Government buildings that are at least 200,000 square feet; four-year colleges and universities that are estimated to have at least 1,000,000 square feet of floorspace; hospitals that are estimated to have at least 200,000 square feet of floorspace; and a list of large buildings over 200,000 square feet. The large building list will be constructed using a building file purchased from Dun & Bradstreet. A list of airports acquired from the FAA is also being added for the 2007 CBECS after it became apparent in 2003 that airport terminals were another large building type that was not being adequately represented in the CBECS sample.

Sample Size

Approximately 8,275 buildings (including strip malls) and 1,180 mall establishments will be selected for the 2007 CBECS sample.

Estimation Procedures

Population Parameters: Estimates of population parameters will be prepared by weighting the values from the sample. For each sampled building, the basic weight will be equal to the inverse of the probability of selecting the building. These basic weights will be adjusted to account for nonresponse.

Variance Estimates: Variance estimates and relative standard error (RSE) estimates will be calculated by means of a replication technique such as the Jackknife or Balanced Repeated Replications (BRR). The generalized RSEs for the statistics in the cells of most CBECS report tables will be expressed in separate RSE tables.

Data Collection

The 2007 CBECS will collect energy-related building characteristics and energy consumption and expenditures information from a sample of U.S. commercial buildings. These data will be collected on Form EIA-871A, I, and J during a voluntary computer-assisted personal interview with buildings' owners, managers or tenants. The majority of respondents will be administered Form EIA-871A, which is the Building Questionnaire. Data for strip shopping centers will be collected via several interviews with several different respondents. The strip mall manager or leasing agent will be administered Form EIA-871I, which will collect general information on the mall structure; several establishments within the mall will be subsampled and respondents from each of those businesses will be asked questions pertaining specifically to that establishment, such as operating characteristics, equipment used, and energy consumption.

Respondents will be provided worksheets (Forms EIA-871G and H) to complete prior to the personal interview. These worksheets will be formatted slightly differently depending on the interview type - for example, not all questions will appear on the versions to be used for the strip mall building and the mall establishment questionnaire forms, and the words "establishment" and "mall building" will be substituted for "building" on the mall building and the establishment questionnaire worksheets. Respondents to the mall building questionnaire will not require Form EIA-871H. The worksheets will help the interview to proceed more quickly and smoothly by allowing the respondent to obtain answers to several of the questions that may require some research prior to the interview.

In cases where the building respondent is unable to provide the consumption and expenditure data, the respondent will be asked to sign an authorization form (Form EIA-871B) to the survey contractor, giving their energy suppliers permission to release their billing records for the building. In these cases, the consumption and expenditures data will be collected from the energy suppliers on Forms EIA-871C-F during a mail survey. The energy supplier will be asked to provide the annual amount of energy sold, the annual cost of the energy, the billing dates, and other pertinent data specific to each type of energy source. The energy supplier data will be

linked to the results of the Building Questionnaire for analysis purposes. Response to the energy suppliers forms (EIA-871C-F) is mandatory for the supplier.

The respondent burden on energy suppliers will be reduced because, for a substantial number of buildings, the energy consumption and expenditures data will be collected at the building level rather than at the supplier level. This will result in fewer forms the energy suppliers will have to process and increased overall efficiency. In 2003, only about 20 percent of cases that used electricity ended up with consumption data that came from the supplier; for natural gas, about 26 percent.

In the cases where energy suppliers must be contacted to obtain the consumption and expenditures data, the EIA does not require these suppliers to transcribe the data onto the survey forms. EIA will accept responses from the energy suppliers in any format (such as a computer printout or on a personal computer diskette) as long as all the necessary information is provided.

Similar to previous CBECS, the 2007 CBECS will not survey buildings or suppliers for the consumption of district chilled water or bottled gas (LPG or propane).

B-3. Maximizing the Response Rate

The data collection contractors will use procedures similar to those used on previous surveys to maximize the response rate for the 2007 CBECS with some additional effort. Over the years, the response rates to the survey have been quite high: averaging about 91 percent for the Building Characteristics Survey and about 85 percent for the Energy Suppliers Survey. The 2003 CBECS response rates were 82 percent for the Building Characteristics Survey and approximately 70 percent for the Energy Suppliers Survey. It is recognized that response rates have been declining over the years, so great effort will be made in 2007 in an attempt to reverse that trend.

Procedures that will be used to maximize the response rate make use of extensive pre-data collection procedures that include:

- Training interviewers in refusal aversion;
- Emphasis on the importance of the content of the survey;
- Locating a knowledgeable respondent;
- Mailing letters signed by a Department of Energy official to the respondent to inform them about the survey;
- Providing the identified respondent a packet of materials consisting of information about the survey, worksheets to assist them with the interview, and an introductory letter signed by the EIA Division Director;
- Including a well-designed brochure in the packet of materials that highlights the importance of the CBECS and why their participation is so vital;
- Setting an appointment to conduct the interview;
- Providing a Help Center with a toll-free number for the respondents to call with any questions or concerns; and
- Following up with nonrespondents by various methods such as reminder letters (tailored for the reason for reluctance) and telephone calls for building owners or managers.

To adjust for nonresponding buildings, EIA adjusts the weights on responding buildings so that responding buildings represent not only nonsampled buildings but also nonrespondents.

B-4. Tests of the Procedures

Two building types that often present difficulty in data collection for the CBECS – hospitals and malls – were investigated through some pre-design consultations during 2006 by EIA and the CBECS contractor.

The EIA CBECS team visited several DC metropolitan area hospitals and spoke with their facilities staff to help understand how the plant managers conceptualize their energy equipment (hospitals often have central plants, either separate from or within the building) and how we might help them to more easily answer the CBECS questions as they relate to the complex energy systems often found at hospitals.

The survey contractor consulted with both enclosed mall and strip shopping center leasing agents and managers to determine which areas of the CBECS questionnaire they might be equipped to answer. Based on these consultations, EIA determined that enclosed mall respondents would be able to provide information for the entire structure, but that for strip shopping centers, it would be more efficient to split up the questionnaire into two parts – a mall building and mall establishment questionnaire, as described in the “Changes for the 2007 CBECS” section.

A full pretest of the CBECS questionnaire and survey operations is planned for October 4, 2007 through November 5, 2007. Approximately 24 interviews will be conducted. The purpose of the pretest is to ensure that the computerized survey instrument is working properly, to evaluate the utility of the tools provided to the interviewers, and to test the new questions that were added as a result of comments from CBECS users. Depending on the results of this pretest, minor changes may be made to survey protocol and questionnaire wording. EIA does not expect major revisions to the survey design to occur as a result of the pretest.

B-5. Statistical Consultations

EIA has chosen the National Opinion Research Center (NORC) as the survey contractor for the CBECS building survey. At NORC, the program director is Krishna Winfrey. Ms. Winfrey may be reached at (312) 759-4225 or by e-mail at Winfrey-Krishna@norc.org. The lead senior statistician from NORC is Stephanie Eckman. Ms. Eckman may be reached at (202) 223-3411 or by e-mail at Eckman-Stephanie@norc.org. The principal EIA official directing the 2007 CBECS is Joelle Michaels. Ms. Michaels may be reached at (202) 586-8952 or by e-mail at joelle.michaels@eia.doe.gov.

The agency point-of-contact regarding this clearance is Grace Sutherland. Ms. Sutherland may be reached at (202) 586-6264 or by e-mail at grace.sutherland@eia.doe.gov.

APPENDICES

Appendix 1: Letters to Survey Respondents

- Advance Letter
- Refusal Letter (General)
- Refusal Letter (Legitimacy)
- Refusal Letter (Confidentiality)

Appendix 2: Questionnaire Forms

- Building Questionnaire (EIA-871A)
- Mall Building Questionnaire (EIA-871I)
- Mall Establishment Questionnaire (EIA-871J)

Appendix 3: Worksheets

- Worksheet 1 (EIA-871G) – Building Questionnaire version
- Worksheet 1 (EIA-871G) – Mall Building Questionnaire version
- Worksheet 1 (EIA-871G) – Mall Establishment Questionnaire version
- Worksheet 2 (EIA-871H) – Building Questionnaire version
- Worksheet 2 (EIA-871H) – Mall Establishment Questionnaire version

Appendix 4: Authorization Form and Energy Supplier Forms

- Authorization Form (EIA-871B)
- Natural Gas Usage (EIA-871C)
- District Heating Usage (EIA-871D)
- Electricity Usage (EIA-871E)
- Building Fuel Oil Usage (EIA-871F)

See www.eia.doe.gov/emeu/cbecs for a list of CBECS products