Supporting Statement for Annual Manufacturing Energy Consumption Survey

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Part B: Collections of Information Employing Statistical Methods
OMB No. 1905-NEW

Form EIA-847, Annual Manufacturing Energy Consumption Survey

Independent Statistics and Analysis
U.S. Energy Information Administration

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Form EIA-847, *Annual Manufacturing Energy Consumption Survey*, is a mandatory survey that collects data on energy consumption and expenditure data from a subset of establishments in the manufacturing sector, i.e., North American Industry Classification System (NAICS) codes 31-33. The information from this survey is used to publish aggregate statistics, at the National level, on the consumption of energy for fuel and nonfuel purposes. The Annual MECS will also be used to benchmark EIA's industry forecasting model and update changes.

The 2025 Annual MECS survey will largely follow the 2022 MECS design. The 2025 Annual MECS will use the 2022 quadrennial MECS sample to identify establishments eligible for the Annual MECS. The U.S. Census Bureau will conduct the data collection for the survey, acting as EIA's data collection agent.

An Internet-based electronic reporting method will be available for the 2025 Annual MECS. The Census Bureau will mail a letter. The letter will give detailed instructions on how to complete the questionnaire through the Internet. Nonresponse follow-up procedures, as described in Section B.3 below, will be similar to those used in 2022, which are performed to maximize response rate. Data processing and editing will be aided by modernized, automated data entry and storage equipment and editing procedures. The 2025 Annual MECS will use a form of data perturbation as the primary disclosure avoidance method, specifically multiplicative noise. This change will allow for an accelerated timeline as compared to the quadrennial MECS.

B.1. Respondent Universe

The target population for the 2025 Annual MECS will consist of U.S. manufacturing establishments in the six most energy-intensive manufacturing subsectors that were active in 2025 with paid employees, except for small single-establishment companies that make up less than 3% of the total 2025 U.S. manufacturing payroll, and the 2025 Annual MECS sample size will be approximately 4,500 establishments. The frame for the Annual MECS will be based on the 2022 quadrennial MECS sample. The frame for the 2022 quadrennial MECS is based largely on the NAICS classifications of the 2021 Business Register and the annual payroll thresholds by industry established for the 2017 Economic Census of Manufactures (ECM) mail-out, which cover approximately 170,000 manufacturing establishments and accounted for the top 97 percent of the total 2022 U.S. manufacturing payroll.

B.2. Statistical Methods

The sampling frame for the 2025 Annual MECS sample is constructed from a list of establishments from the 2022 quadrennial MECS which comes from the Census Bureau’s 2021 Business Register. The establishments from the Census Bureau’s Business Register include all manufacturing establishments in the U.S. that are active in 2021 with paid employees, except for small single-establishment companies. These small single-establishment companies have 2021 payroll below annual cutoffs that were determined using payroll data from the 2017 Economic Census.

The 2025 Annual MECS frame will be stratified by NAICS industry with some provisions to also stratify according to Census Region. Independent samples are selected by stratum. A major portion of the Annual MECS sample will be devoted to the strata defined by specific energy-intensive 3-digit NAICS subsectors that comprise U.S. manufacturing, as well as 12 4-digit and 6-digit NAICS industry groups and industries, at the National level. The industry groups and sub-industries will be chosen based upon their

fuel consumption, economic output, feedstock usage, and other programmatic interests. All establishments classified in one of six specified industries are expected to be selected in the Annual MECS sample with certainty. For other industries, maximum bounds on the sampling weights and target coefficients of variation (CVs) for estimating total measure of size are set depending on the NAICS level (six, four, or three digit) as well as other factors such as energy intensity.

The measure of size (MOS) is used to assign overall probabilities of Annual MECS selection to each establishment, excluding the Annual MECS certainty strata. The 2025 Annual MECS MOS will be the sum of annual cost of fuel and cost of electricity (CF). These data come from the 2022 quadrennial MECS or from the 2022 ECM.

The MECS uses a probability proportionate to size (PPS) approach to assigning inclusion probabilities to manufacturing establishments in the non-certainty strata. However, the MOS is not highly correlated with measured values of energy consumed as feedstock and certain energy sources used as fuel. To address this, as in previous MECS, the 2025 Annual MECS will select all establishments in the frame known to be significant consumers in these areas.

After the inclusion probabilities are assigned, a modified version of a sample selection algorithm called Pareto sampling[1] is employed to obtain the 2025 Annual MECS sample in each of the remaining stratum. Since the 1998 MECS, the sample in each stratum has been of a fixed, predetermined size. This benefits the MECS by preventing cost overruns due to the actual sample size being larger than expected. Additionally, this selection method has been used since the 2010 MECS, instead of Tillé sampling, because the variance is simple and easy to estimate and does not involve joint probabilities. Also, Pareto sampling is easy to implement and to transfer knowledge to maintain the sampling program if in the future certain modifications are desired. Below is a description of the weighting and estimation process for the noncertainty establishments.

The statistic reported for each stratum is an estimator of the total of some measure of energy consumption (e.g. the total natural gas, in billion cubic feet, for the Northeast primary metals industry). Modified Horvitz-Thompson estimators are used for estimating totals. For each stratum, the estimates are of the following form:

$$\hat{Y}_s = \sum_{i=1}^{n_s} w_i^{adj} \cdot (y_i)$$

where:

y_i, $i = 1 : n_s$, are the values of the consumption measure for the n_s establishments in stratum s that were selected for the sample and responded.

w_i^{adj}, $i = 1 : n_s$, are the final weights for the n_s establishments in stratum s that were selected for the sample and responded, where the final weight for an establishment is the sample weight, which is

[1] Pareto sampling was introduced in two articles by Bengt Rosén [Journal of Statistical Planning and Inference 62 (1997) pp. 135-158 and pp. 159-191]. It is also referenced by Särndal and Lundström (Estimation in Surveys with Nonresponse, Wiley 2005 p. 31).

defined as the inverse of the establishment's probability of selection, multiplied by an adjustment factor that corrects for unit nonresponse and births and deaths in the population using data extracted from the 2025 Business Register and 2025 AIES.

$\hat{Y}_s$ is an estimate for $Y_s = \sum_{i=1}^{N_s} y_i$ which is the actual total for stratum *s*

Population totals will be estimated from 2025 Annual MECS data by summing the weighted sample data based on the final weights. For the 2010, 2014, 2018, and 2022 MECS, the adjustment factors were calculated separately for certainty and non-certainty establishments within adjustment cells that were based on the strata. That practice will likely be continued for the 2025 annual survey.

B.3. Maximizing Response Rates

To maximize response rates, EIA survey questionnaires and instructions are designed and written for clarity and conciseness. Data not expected to change from year-to-year are prepopulated on the forms. Notifications are mailed to maximize the time that respondents have to complete the survey.
The weighted coverage rate (ratio of the total weighted MOS of the responders to the total weighted MOS of all establishments in the sample) for the 2022 MECS was approximately 80 percent. By using the Census Bureau as the data-collection agent, the survey is not only under the data-collection authority of the DOE mandate, but also has the confidentiality protection that Title 13, Section 9, of the U.S. Code confers on surveys conducted by the Census Bureau.

The Census Bureau has developed standard procedures for nonresponse follow-up and calculation of response rates. The Census Bureau will conduct two mail follow-ups, as well as a telephone follow-up of the largest delinquents. Smaller delinquents will receive only the two mail follow-ups. An enhancement to the telephone nonresponse follow-up instituted for the 2002 MECS, and used for every MECS telephone nonresponse follow-up since, will be continued for the 2025 Annual MECS. In that procedure, follow-up was done to maximize response of establishments that have the greatest MOS in the adjustment cells used in estimation. The procedure established target coverage rates (ratio of the total MOS of the responders to the total MOS for all sampled establishments in each stratum) for the follow-up based on the overall importance of the cell.

B.4. Test Procedures and Form Consultations

This will be the first time the Annual MECS will be conducted. After consideration of past results and outside consultations (as described in Section A.8), the questionnaire has undergone substantial redesign in the method of collection. The effectiveness of these changes was analyzed during the editing and review of the 2010 MECS data. The respondents actively supported the changes during the post-survey interviews of respondents in 2012. The few changes to the instrument for 2022 targeted opportunities for increased data reporting frequency, improved data quality, and reporting efficiency. The 2025 annual questionnaire will be similar in structure to the quadrennial questionnaire but only ask

questions about 5 common energy sources. This significantly reduces the size of the 2025 annual questionnaire compared to the more comprehensive quadrennial questionnaire, however no other changes are anticipated for the 2025 Annual MECS.

In carrying out the 2025 Annual MECS, the Census Bureau will use data collection procedures like those used for the 2022 MECS. No further tests of procedures are planned.

B.5. Statistical Consultations

The U.S. Bureau of the Census is selecting the AMECS sample under the supervision of Toni Warner, Chief of the Manufacturing Surveys Statistical Methods Branch. Ms. Warner can be reached at (301) 763-5983. The overall administrative responsibility for AMECS at the Census Bureau rests with Michael Sprung Acting Division Chief of the Economy Wide Surveys Division. Mr. Sprung can be reached at (301) 763-7150. For questions or additional information regarding the statistical methods for this survey, contact Tom Lorenz, Survey Statistician, at (202) 586-3442, email Thomas.lorenz@eia.gov, of the Office of Energy Consumption and Efficiency Statistics within the Office of Energy Statistics of the U.S. Energy Information Administration.