

# Technical Notes

The Energy Information Administration (EIA) periodically reviews and revises how it collects, estimates, and reports data pertaining to the electric power industry. These Technical Notes describe current data quality efforts and measures as well as each active survey form contributing to the data published in the *Electric Power Monthly (EPM)*.

## Data Quality

The *EPM* is prepared by the Electric Power Division, Office of Coal, Nuclear, Electric and Alternate Fuels (CNEAF), Energy Information Administration (EIA), U.S. Department of Energy. Quality statistics begin with the collection of the correct data. To assure this, CNEAF performs routine reviews of the data collected and the forms on which it is collected. Additionally, to assure that the data are collected from the correct parties, CNEAF routinely reviews the frames for each data collection.

Automatic, computerized verification of keyed input, review by subject matter specialists, and follow-up with nonrespondents assure quality statistics. To ensure the quality standards established by the EIA, formulas that use the past history of data values in the database have been designed and implemented to check data input for errors automatically. Data values that fall outside the ranges prescribed in the formulas are verified by telephoning respondents to resolve any discrepancies. All survey nonrespondents are identified and contacted.

## Reliability of Data

There are two types of errors possible in an estimate based on a sample survey: sampling and nonsampling. Sampling errors occur because observations are made only on a sample, not on the entire population. Non-sampling errors can be attributed to many sources in the collection and processing of data. The accuracy of survey results is determined by the joint effects of sampling and nonsampling errors. Monthly sample survey data have both sampling and nonsampling error. Annual survey data are collected by a census and are not subject to sampling error.

Nonsampling errors can be attributed to many sources: (1) inability to obtain complete information about all cases in the sample (i.e., nonresponse); (2) response errors; (3) definitional difficulties; (4) differences in the interpretation of questions; (5) mistakes in recording or coding the data obtained; and (6) other errors of collection, response, coverage, and estimation for missing data. Note that for the cutoff sampling and model-based regression (ratio) estimation that we use, data ‘missing’ due to

nonresponse, and data ‘missing’ due to being out-of-sample are treated in the same manner. Therefore missing data may be considered to result in sampling error, and variance estimates reflect all missing data.

Although no direct measurement of the biases due to nonsampling errors can be obtained, precautionary steps were taken in all phases of the frame development and data collection, processing, and tabulation processes, in an effort to minimize their influence. See the Data Processing and Data System Editing section for each EIA Form for an in depth discussion of how the sampling and nonsampling errors are handled in each case<sup>2,3,5,14,15,19,25</sup>.

**Relative Standard Error.** The relative standard error (RSE) statistic, usually given as a percent, describes the magnitude of sampling error that might reasonably be incurred<sup>11,14,17</sup>. The RSE is the square root of the estimated variance, divided by the variable of interest. The variable of interest may be the ratio of two variables, or a single variable<sup>12</sup>.

The sampling error may be less than the nonsampling error. In fact, large RSE estimates found in preliminary work with these data have often indicated nonsampling errors, which were then identified and corrected. Nonsampling errors may be attributed to many sources, including the response errors, definitional difficulties, differences in the interpretation of questions, mistakes in recording or coding data obtained, and other errors of collection, response, or coverage. These nonsampling errors also occur in complete censuses. In a complete census, this problem may become unmanageable.

Using the Central Limit Theorem, which applies to sums and means such as are applicable here, there is approximately a 68-percent chance that the true total or mean is within one RSE of the estimated total or mean. Note that reported RSEs are always estimates themselves, and are usually, as here, reported as percents. As an example, suppose that a net generation from coal value is estimated to be 1,507 million kilowatthours with an estimated RSE of 4.9 percent. This means that, ignoring any nonsampling error, there is approximately a 68-percent chance that the true million kilowatthour value is within approximately 4.9 percent of 1,507 million kilowatthours (that is, between 1,433 and 1,581 million kilowatthours). Also under the Central Limit Theorem, there is approximately a 95-percent chance that the true mean or total is within 2 RSEs of the estimated mean or total.

Note that there are times when a model may not apply, such as in the case of a substantial reclassification of sales, when the relationship between the variable of interest and the regressor data does not hold. In such a case, the new information may represent only itself, and such numbers

are added to model results when estimating totals. Further, there are times when sample data may be known to be in error, or are not reported. Such cases are treated as if they were never part of the model-based sample, and values are imputed. Experiments were done to see if nonresponse should be treated differently, but it was decided to treat those cases the same as out-of-sample cases<sup>14, 18, 23</sup>.

**Relative Standard Error With Respect to a Superpopulation.** The RSESP statistic is similar to the RSE (described above). Like the RSE, it is a statistic designed to estimate the variability of data and is usually given as a percent. However, where the RSE is only designed to estimate the magnitude of sampling error, the RSESP more fully reflects the impact of variability from both sampling and non-sampling errors<sup>15, 16, 17, 20</sup>. This is a more complete measure than RSE in that it can measure statistical variability in a complete census in addition to a sample<sup>17, 20</sup>. In addition to being a measure of data variability, the RSESP can also be useful in comparing different models that are applied to the same set of data<sup>18</sup>. This capability is used to test different regression models for imputation and prediction. This testing may include considerations such as comparing different regressors, the comparative reliability of different monthly samples, or the use of different geographical strata or groupings for a given model. For testing purposes, CNEAF typically uses recent historical data that have been finalized. Typically, time-series graphics showing two or more models or samples are generated showing the RSESP values over time. In selecting models, consideration is given to total survey error as well as any apparent differences in robustness<sup>14</sup>.

**Imputation.** For monthly data, if the reported values appeared to be in error and the data issue could not be resolved with the respondent, or if the facility was a nonrespondent, a regression methodology is used to impute for the facility<sup>11, 12, 18, 19, 21</sup>. The same procedure is used to estimate ("predict") data for facilities not in the monthly sample. The regression methodology relies on other data to make estimates for erroneous or missing responses.

The basic technique employed is described in the paper "Model-Based Sampling and Inference<sup>12</sup>," on the EIA website. Additional references can be found on the InterStat website. The basis for the current methodology involves a 'borrowing of strength' technique for small domains<sup>11, 13, 14</sup>.

## Data Revision Procedure

CNEAF has adopted the following policy with respect to the revision and correction of recurrent data in energy publications:

- Annual survey data are disseminated either as preliminary or final when first appearing in a data product. Data initially released as preliminary will be so noted in the data product. These data are typically released as final by the next dissemination of the same product; however, if

final data are available at an earlier interval they may be released in another product.

- All monthly survey data are first disseminated as preliminary. These data are revised after the prior year's data are finalized and are disseminated as revised preliminary. No revisions are made to the published data before this or subsequent to these data being finalized unless significant errors are discovered.
- After data are disseminated as final, further revisions will be considered if they make a difference of 1 percent or greater at the national level. Revisions for differences that do not meet the 1 percent or greater threshold will be determined by the Office Director. In either case, the proposed revision will be subject to the EIA revision policy concerning how it affects other EIA products.
- The magnitudes of changes due to revisions experienced in the past will be included periodically in the data products, so that the reader can assess the accuracy of the data.

In accordance with the policy statement above, the mean absolute value for the 12 monthly revisions of each item are provided at the U.S. level for the years 2004 through 2006 (Table C2). For example, the mean (in percentage terms) of the 12 monthly absolute differences between preliminary and final monthly data for coal-fired generation in 2006 was 0.19. That is, on average, the mean absolute value of the change made each month to coal-fired generation was 0.19 percent.

## Data Sources For Electric Power Monthly

Data published in the *Electric Power Monthly (EPM)* are compiled from the following sources: Form EIA-923, "Power Plant Operations Report," Form EIA-826, "Monthly Electric Utility Sales and Revenues with State Distributions Report," Form EIA-860, "Annual Electric Generator Report," Form EIA-860M, "Monthly Update to the Annual Electric Generator Report," and Form EIA-861, "Annual Electric Power Industry Report." For access to these forms and their instructions, please see: <http://www.eia.doe.gov/cneaf/electricity/page/forms.html>.

In addition to the above-named forms, the historical data published in the *EPM* for periods prior to 2008 are compiled from the following sources: FERC Form 423, "Monthly Report of Cost and Quality of Fuels for Electric Plants," Form EIA-423, "Monthly Cost and Quality of Fuels for Electric Plants Report," Form EIA-759, "Monthly Power Plant Report," Form EIA-860A, "Annual Electric Generator Report–Utility," Form EIA-860B, "Annual Electric Generator Report–Nonutility," Form EIA-900, "Monthly Nonutility Power Report," Form EIA-906, "Power Plant Report," and Form EIA-920, "Combined Heat and Power Plant Report." See Appendix

A of the historical Electric Power Annuals to find descriptions of forms that are no longer in use. The publications are located at:

<http://www.eia.doe.gov/cneaf/electricity/epa/backissues.html>

**Rounding Rules for Data.** To round a number to n digits (decimal places), add one unit to the nth digit if the (n+1) digit is 5 or larger and keep the nth digit unchanged if the (n+1) digit is less than 5. The symbol for a number rounded to zero is (\*).

**Percent Difference.** The following formula is used to calculate percent differences.

$$\text{Percent Difference} = \left( \frac{x(t_2) - x(t_1)}{|x(t_1)|} \right) \times 100,$$

where  $x(t_1)$  and  $x(t_2)$  denote the quantity at year  $t_1$  and subsequent year  $t_2$ .

## Form EIA-826

The Form EIA-826, “Monthly Electric Utility Sales and Revenues with State Distributions Report,” is a monthly collection of data from a sample of approximately 450 of the largest electric utilities (primarily investor-owned and publicly owned) as well as a census of energy service providers with retail sales in deregulated States. Form EIA-861, with approximately 3,300 respondents, serves as a frame from which the Form 826 sample is drawn. Based on this sample, a model is used to estimate for the entire universe of U.S. electric utilities.

**Instrument and Design History.** The collection of electric power sales data and related information began in the early 1940’s and was established as FPC Form 5 by FPC Order 141 in 1947. In 1980, the report was revised with only selected income items remaining and became the FERC Form 5. The Form EIA-826, “Electric Utility Company Monthly Statement,” replaced the FERC Form 5 in January 1983. In January 1987, the “Electric Utility Company Monthly Statement” was changed to the “Monthly Electric Utility Sales and Revenue Report with State Distributions.” The title was changed again in January 2002 to “Monthly Electric Utility Sales and Revenues with State Distributions Report” to become consistent with other EIA report titles. The Form EIA-826 was revised in January 1990, and some data elements were eliminated.

In 1993, EIA for the first time used a model sample for the Form EIA-826. A stratified random sample, employing auxiliary data, was used for each of the four previous years<sup>6,7,8,9</sup>. The sample for the Form EIA-826 was designed to obtain estimates of electricity sales and average retail price of electricity at the State level by end-use sector.

Starting with data for January 2001, the restructuring of the electric power industry was taken into account by forming three schedules on the Form EIA-826. Schedule 1, Part A is for full service utilities that operate as in the past. Schedule 1, Part B is for electric service providers

only, and Schedule 1, Part C is for those utilities providing distribution service for those on Schedule 1, Part B. In addition, Schedule 1 Part D is for those retail energy providers or power marketers that provide bundled service. Also, the Form EIA-826 frame was modified to include all investor-owned electric utilities and a sample of companies from other ownership classes. A new method of estimation was implemented at this same time. (See *EPM* April 2001, p.1.)

With the October 2004 issue of the Electric Power Monthly (EPM) EIA published for the first time preliminary electricity sales data for the Transportation Sector. These data are for electricity delivered to and consumed by local, regional, and metropolitan transportation systems. The data being published for the first time in the October EPM include July 2004 data as well as year-to-date. EIA’s efforts to develop these new data have identified anomalies in several States and the District of Columbia. Some of these anomalies are caused by issues such as: 1) Some respondents have classified themselves as outside the realm of the survey. The Form EIA-826 collects retail data from those respondents providing electricity and other services to the ultimate end users. EIA has experienced specific situations where, although the respondents’ customers are the ultimate end users, particular end users qualify under wholesale rate schedules. 2) The Form EIA-826 is a cutoff sample and not intended to be a census<sup>3,6,19</sup>.

The legislative authority to collect these data is defined in the Federal Energy Administration Act of 1974 (Public Law 93-275, Sec. 13(b), 5(a), 5(b), 52).

**Data Processing and Data System Editing.** Monthly Form EIA-826 submission is available via an Internet Data Collection (IDC) system. The completed data are due to EIA by the last calendar day of the month following the reporting month. Nonrespondents are contacted to obtain the data. The data are edited and additional checks are completed. Following verification, imputation is run, and tables and text of the aggregated data are produced for inclusion in the EPM.

**Imputation.** Regression prediction, or imputation, is done for entities not in the monthly sample and for any nonrespondents. Regressor data for Schedule 1, Part A is the average monthly sales or revenue from the most recent finalized data from Survey Form EIA-861. Beginning with January 2008 data and the finalized 2007 data<sup>i</sup>, the regressor data for Schedule 1 Parts B and C is the prior month’s data<sup>ii</sup>.

**Formulas and Methodologies.** The Form EIA-826 data are collected by end-use sector (residential, commercial, industrial, and transportation) and state. Form EIA-861 data are used as the frame from which the sample is selected and in some instances also as regressor data.

<sup>i</sup> Data from 2007 will be finalized with the publication of the *Electric Power Annual 2007*.

<sup>ii</sup> If a census of schedules B and C is not available for the prior month, the most recent completely censused prior month is used.

Updates are made to the frame to reflect mergers that affect data processing.

With the revised definitions for the commercial and industrial sectors to include all data previously reported as 'other' data except transportation, and a separate transportation sector, all responses that would formerly have been reported under the "other" sector are now to be reported under one of the sectors that currently exist. This means there is probably a lower correlation, in general, between, say, commercial Form EIA-826 data for 2004 and commercial Form EIA-861 data for 2003 than there was between commercial Form EIA-826 data for 2003 and commercial Form EIA-861 data for 2002 or earlier years, although commercial and industrial definitions have always been somewhat nebulous due to power companies not having complete information on all customers.

Data submitted for January 2004 represent the first time respondents were to provide data specifically for the transportation end-use sector.

During 2003 transportation data were collected annually through Form EIA-861. Beginning in 2004 the transportation data were collected on a monthly basis via Form EIA-826. In order to develop an estimate of the monthly transportation data for 2003, values for both retail sales of electricity to ultimate customers and revenue from retail sales of electricity to ultimate customers were estimated using the 2004 monthly profile for the sales and revenues from the data collected via Form EIA-826. All monthly non-transportation data for 2003 (i.e. street lighting, etc.), which were previously reported in the "other" end-use sector on the Form EIA-826 have been prorated into the Commercial and Industrial end-use sectors based on the 2003 Form EIA-861 profile.

A monthly distribution factor was developed for the monthly data collected in 2004 (for the months of January through November). The transportation sales and revenues for December 2004 were assumed to be equivalent to the transportation sales and revenues for November 2004. The monthly distribution factors for January through November were applied to the annual values for transportation sales and revenues collected via Form EIA-861 to develop corresponding 2003 monthly values. The eleven month estimated totals from January through November 2003 were subtracted from the annual values obtained from Form EIA-861 in order to obtain the December 2003 values.

Data from the Form EIA-826 are used to determine estimates by sector at the State, Census Division, and national level. State level sales and revenues estimates are first calculated. Then the ratio of revenue divided by sales is calculated to estimate retail price of electricity at the State level. The estimates are accumulated separately to produce the Census Division and U.S. level estimates<sup>13</sup>.

Some electric utilities provide service in more than one State. To facilitate the estimation, the State-service area is actually used as the sampling unit. For each State served by each utility, there is a utility State-part, or

"State-service area." This approach allows for an explicit calculation of estimates for sales, revenue, and average retail price of electricity by end-use sector at State, Census Division, and national level. Estimation procedures include imputation to account for nonresponse. Nonsampling error must also be considered. The nonsampling error is not estimated directly, although attempts are made to minimize the nonsampling error<sup>11,12,13,14,15,20</sup>.

Average retail price of electricity represents the cost per unit of electricity sold and is calculated by dividing retail electric revenue by the corresponding sales of electricity. The average retail price of electricity is calculated for all consumers and for each end-use sector.

The electric revenue used to calculate the average retail price of electricity is the operating revenue reported by the electric utility. Operating revenue includes energy charges, demand charges, consumer service charges, environmental surcharges, fuel adjustments, and other miscellaneous charges. Electric utility operating revenues also include State and Federal income taxes and taxes other than income taxes paid by the utility.

The average retail price of electricity reported in this publication by sector represents a weighted average of consumer revenue and sales within sectors and across sectors for all consumers, and does not reflect the per kWh rate charged by the electric utility to the individual consumers. Electric utilities typically employ a number of rate schedules within a single sector. These alternative rate schedules reflect the varying consumption levels and patterns of consumers and their associated impact on the costs to the electric utility for providing electrical service.

**Adjusting Monthly Data to Annual Data.** As a final adjustment based on our most complete data, use is made of final Form EIA-861 data, when available. The annual totals for Form EIA-826 data by State and end-use sector are compared to the corresponding Form EIA-861 values for sales and revenue. The ratio of these two values in each case is then used to adjust each corresponding monthly value.

**Sensitive Data (Formerly identified as Data Confidentiality).** Most of the data collected on the Form EIA-826 are not considered business sensitive. However, revenue, sales, and customer data collected from energy service providers (Schedule 1, Part B), which do not also provide energy delivery, are considered business sensitive and must adhere to EIA's "Policy on the Disclosure of Individually Identifiable Energy Information in the Possession of the EIA" (45Federal Register 59812 (1980)).

## Form EIA-860

The Form EIA-860, "Annual Electric Generator Report," is a mandatory census of all existing and planned electric power plants in the United States with a total generator nameplate capacity of 1 or more megawatts. The survey is

used to collect data on existing power plants and 5-year plans for constructing new plants, generating unit additions, modifications, and retirements in existing plants. Data on the survey are collected at the generator level. Certain power plant environmental related data are collected at the boiler level. These data include environmental equipment design parameters and boiler air emission standards and boiler emission controls. The Form EIA-860 is made available in January to collect data related to the previous year. The completed survey is due to EIA by February 15 of each year.

**Instrument and Design History.** The Form EIA-860 was originally implemented in January 1985 to collect data as of year-end 1984. In January 1999, the Form EIA-860 was renamed the Form EIA-860A, “Annual Electric Generator Report – Utility” and was implemented to collect data from electric utilities as of January 1, 1999. At the same time, Form EIA-867, “Annual Nonutility Power Producer Report,” was renamed Form EIA-860B, “Annual Electric Generator Report – Nonutility” to collect data from nonutilities.

Beginning with data collected for the year 2001, the infrastructure data collected on the Form EIA-860A and the Form EIA-860B were combined into the new Form EIA-860 and the monthly and annual versions of the Form EIA-906.

Beginning with data collected for the calendar year ending December 31, 2007, Form EIA-860 is revised to include the collection of boiler level data related to air emission standards and emission controls along with design parameters of associated environmental related equipment.

The Federal Energy Administration Act of 1974 (Public Law 93-275) defines the legislative authority to collect these data.

#### **Data Processing and Data System Editing.**

Approximately 2,700 respondents are requested to provide data as of December 31 on the Form EIA-860. Computer programs containing edit checks are run to identify errors. Respondents are contacted to obtain correction or clarification of reported data and to obtain missing data, as a result of the editing process.

**Sensitive Data (Formerly identified as Data Confidentiality).** Tested heat rate data collected on Form EIA-860 are considered sensitive and must adhere to EIA's “Policy on the Disclosure of Individually Identifiable Energy Information in the Possession of the EIA”. Plant latitude and longitude data provided prior to 2007 are considered sensitive (45Federal Register 59812 (1980)).

#### **Form EIA-860M**

The Form EIA-860M, “Monthly Update to the Annual Electric Generator Report,” is a mandatory monthly survey that collects data on the status of proposed new generators or changes to existing generators for plants that report on Form EIA-860.

The EIA-860M has a rolling frame based upon planned changes to capacity as reported on the previous Form EIA-860. Respondents are added to the frame 12 months prior to expected effective date for all new units or uprates to nuclear units. For all other types of capacity changes (including uprates to non-nuclear generation), respondents are added one month prior to the anticipated on-line date. Respondents are removed from the frame at the completion of the changes or if the change date is moved back so that the plant no longer qualifies to be on the frame. Typically from about 75 to 110 respondents per month are required to report for 90 to 130 plants (including 200 to 300 units) on this form. The unit characteristics of interest are changes to the previously reported on-line month and year, prime mover type, capacity, and energy sources

**Instrument and Design History.** The data collected on Form EIA-860M was originally collected via phone calls at the end of each month. During 2005, the Form EIA-860M was introduced as a mandatory form using the Internet Data Collection (IDC) system.

The legislative authority to collect these data is defined in the Federal Energy Administration Act of 1974 (Public Law 93-275, Sec. 13(b), 5(a), 5(b), 52).

#### **Data Processing and Data System Editing.**

Approximate 75-110 respondents are requested to provide data each month on the EIA-860M. This data is collected via the IDC system and automatically checked for certain errors. Most of the quality assurance issues are addressed by the respondents as part of the automatic edit check process. In some cases, respondents are subsequently contacted about their explanatory overrides to the edit checks.

**Sensitive Data (Formerly identified as Data Confidentiality).** Data collected on the Form EIA-860M are not considered to be sensitive.

#### **Form EIA-861**

The Form EIA-861, “Annual Electric Power Industry Report,” is a mandatory census of electric power industry participants in the United States. The survey is used to collect information on power production and sales data from approximately 3,300 respondents. These include electric utilities, other electricity distributors, and power marketers. The data collected are used to maintain and update the EIA's electric power industry participant frame database. These include electric utilities, other electricity distributors, and power marketers.

**Instrument and Design History.** The Form EIA-861 was implemented in January 1985 for collection of data as of year-end 1984. The Federal Energy Administration Act of 1974 (Public Law 93-275) defines the legislative authority to collect these data.

**Data Processing and Data System Editing.** The Form EIA-861 is made available to the respondents in January

of each year to collect data as of the end of the preceding calendar year. The data are edited when entered into the interactive on-line system. Internal edit checks are performed to verify that current data total across and between schedules, and are comparable to data reported the previous year. Edit checks are also performed to compare data reported on the Form EIA-861 and similar data reported on the Forms EIA-826. Respondents are telephoned to obtain clarification of reported data and to obtain missing data.

Data for the Form EIA-861 are collected at the owner level from all electric utilities including energy service providers in the United States, its territories, and Puerto Rico. Form EIA-861 data in this report are for the United States only.

Average retail price of electricity represents the cost per unit of electricity sold and is calculated by dividing retail electric revenue by the corresponding sales of electricity. The average retail price of electricity is calculated for all consumers and for each end-use sector. A ratio estimation procedure is used for estimation of retail price of electricity at the State level.

The electric revenue used to calculate the average retail price of electricity is the operating revenue reported by the electric power industry participant. Operating revenue includes energy charges, demand charges, consumer service charges, environmental surcharges, fuel adjustments, and other miscellaneous charges. Electric power industry participant operating revenues also include State and Federal income taxes and taxes other than income taxes paid by the utility.

The average retail price of electricity reported in this publication by sector represents a weighted average of consumer revenue and sales within sectors and across sectors for all consumers, and does not reflect the per kWh rate charged by the electric power industry participant to the individual consumers. Electric utilities typically employ a number of rate schedules within a single sector. These alternative rate schedules reflect the varying consumption levels and patterns of consumers and their associated impact on the costs to the electric power industry participant for providing electrical service.

**Sensitive Data (Formerly identified as Data Confidentiality).** Data collected on the Form EIA-861 are not considered to be sensitive.

## Form EIA-923

Form EIA-923, "Power Plant Operations Report," is a monthly collection of data on receipts and cost of fossil fuels, fuel stocks, generation, consumption of fuel for generation, and environmental data (e.g. emission controls and cooling systems). Data are collected from a monthly sample of approximately 1,600 plants, which includes a census of nuclear and pumped storage hydroelectric plants. In addition approximately 3,700 plants, representing all other generators 1 MW or greater, are collected annually. In addition to electric power

generating plants, respondents include fuel storage terminals without generating capacity that receive shipments of fossil fuels for eventual use in electric power generation. The monthly data are due by the last day of the month following the reporting period.

Receipts of fossil fuels, fuel cost and quality information, and fuel stocks at the end of the reporting period are all reported at the plant level. Plants that burn organic fuels and have a steam turbine capacity of at least 10 megawatts report consumption at the boiler level and generation at the generator level. For all other plants, consumption is reported at the prime-mover level. For these plants, generation is reported either at the prime-mover level or, for noncombustible sources (e.g. wind, nuclear), at the prime-mover and energy source level. The source and disposition of electricity is reported annually for nonutilities at the plant level as is revenue from sales for resale. Environmental data are collected annually from facilities that have a steam turbine capacity of at least 10 megawatts.

### Instrument and Design History.

#### *Receipts and Cost and Quality of Fossil Fuels*

On July 7, 1972, the Federal Power Commission (FPC) issued Order Number 453 enacting the New Code of Federal Regulations, Section 141.61, legally creating the FPC Form 423. Originally, the form was used to collect data only on fossil-steam plants, but was amended in 1974 to include data on internal-combustion and combustion-turbine units. The FERC Form 423 replaced the FPC Form 423 in January 1983. The FERC Form 423 eliminated peaking units, for which data were previously collected on the FPC Form 423. In addition, the generator nameplate capacity threshold was changed from 25 megawatts to 50 megawatts. This reduction in coverage eliminated approximately 50 utilities and 250 plants. All historical FPC Form 423 data in this publication were revised to reflect the new generator-nameplate-capacity threshold of 50 or more megawatts reported on the FERC Form 423. In January 1991, the collection of data on the FERC Form 423 was extended to include combined-cycle units. Historical data have not been revised to include these units. Starting with the January 1993 data, the FERC began to collect the data directly from the respondents.

The Form EIA-423 was originally implemented in January 2002 to collect monthly cost and quality data for fossil fuel receipts from owners or operators of nonutility electricity generating plants. Due to the restructuring of the electric power industry, many plants which had historically submitted this information for utility plants on the FERC Form 423 (see above) were being transferred to the nonutility sector. As a result, a large percentage of fossil fuel receipts were no longer being reported. The Form EIA-423 was implemented to fill this void and to capture the data associated with existing non-regulated power producers. Its design closely followed that of the FERC Form 423.

Both the Form EIA-423 and FERC-423 were superseded by Form EIA-923 (Schedule 2) in January of 2008. The

EIA-923 maintains the 50 megawatt threshold for these data. However, not all data are collected monthly on the new form. Beginning with 2008 data, a sample of the respondents will report monthly, with the remainder reporting annually (monthly values will be imputed via regression). For 2007, Schedule 2 annual data will not be collected or imputed. Most of the plants required to report on Schedule 2 already submitted their 2007 receipts data on a monthly basis.

### *Generation, Consumption, and Stocks*

The Bureau of Census and the U.S. Geological Survey collected, compiled, and published data on the electric power industry prior to 1936. After 1936, the Federal Power Commission (FPC) assumed all data collection and publication responsibilities for the electric power industry and implemented the Form FPC-4. The Federal Power Act, Section 311 and 312, and FPC Order 141 defined the legislative authority to collect power production data. The Form EIA-759 replaced the Form FPC-4 in January 1982.

In 1996, the Form EIA-900 was initiated to collect sales for resale data from unregulated entities<sup>10</sup>. In 1998, the form was modified to collect sales for resale, gross generation, and sales to end user data. In 1999, the form was modified to collect net generation, consumption, and ending stock data<sup>11</sup>. In 2000, the form was modified to include the production of useful thermal output data.

In January 2001, Form EIA-906 superseded Forms EIA-759 and EIA-900. In January 2004, Form EIA-920 superseded Form EIA-906 for those plants defined as combined heat and power plants; all other plants that generate electricity continue to report on Form EIA-906. The Federal Energy Administration Act of 1974 (Public Law 93-275) defines the legislative authority to collect these data.

Forms EIA-906 and EIA-920 were superseded by survey form EIA-923 beginning in January 2008 with the collection of annual 2007 data and monthly 2008 data.

**Data Processing and Data System Editing.** Respondents are encouraged to enter data directly into a computerized database via the Internet Data Collection (IDC) system. A variety of automated quality control mechanisms are run during this process, such as range checks and comparisons with historical data. These edit checks were performed as the data were provided, and many problems that are encountered are resolved during the reporting process. Those plants that are unable to use the electronic reporting medium provide the data in hard copy, typically via fax. These data were manually entered into the computerized database. The data were subjected to the same edits as those that were electronically submitted.

If the reported data appeared to be in error and the data issue could not be resolved by follow up contact with the respondent, or if a facility was a nonrespondent, a regression methodology was used to impute for the facility.

**Imputation.** Regression prediction, or imputation, is done for all missing data including non-sampled units and any nonrespondents. Imputation is done for gross generation, total fuel consumption, receipts of fossil fuels, cost of fossil fuel shipments, and stocks. Multiple regression is used for gross generation and total fuel consumption. For gross generation, the regressors are prior year average generation for the same fuel, prior year average generation from other fuels, and nameplate capacity. Regressors for total fuel consumption are prior year average fuel consumption from the same fuel, prior year average consumption from other fuels, and nameplate capacity. Average consumption from the previous year for the same fuel is used as the lone regressor for receipts of fossil fuels and for the cost of fossil fuel shipments. For stocks, a linear combination of the prior month's ending stocks value, and the current month's consumption and receipts values.

Several additional fields are estimated by means other than regression. These include net generation and fuel quality information such as sulfur and Btu (British thermal unit) content. Net generation is computed by a fixed ratio to gross generation by prime-mover type. For fuel quality variables, the observed state average is used for all missing records. In the event that no value is available at the state level, the national average is used. Should the national average also be unavailable, the midpoint of the acceptable range of values<sup>13</sup> is used.

**Receipts of Fossil Fuels.** Receipts data, including cost and quality of fuels, are collected at the plant level from selected electric generating plants and fossil-fuel storage terminals in the United States. These plants include independent power producers, electric utilities, and commercial and industrial combined heat and power producers whose total fossil-fueled nameplate capacity is 50 megawatts or more (excluding storage terminals, which do not produce electricity). The data on cost and quality of fuel shipments are then used in the following formulas to produce aggregates and averages for each fuel type at the State, Census Division, and U.S. level. For these formulas, receipts and average heat content are at the plant level. For each geographic region, the summation sign,  $\sum$ , represents the sum of all facilities in that geographic region.

For coal, units for receipts are in tons and units for average heat contents (A) are in million Btu per ton.

For petroleum, units for receipts are in barrels and units for average heat contents (A) are in million Btu per barrel.

For gas, units for receipts are in thousand cubic feet (Mcf) and units for average heat contents (A) are in million Btu per thousand cubic foot.

<sup>13</sup> The ranges used are the same as are used for range checks during data collection.

For each of the above fossil fuels:

$$\text{Total Btu} = \sum_i (R_i \times A_i),$$

where  $i$  denotes a facility;  $R_i$  = receipts for facility  $i$ ;

$A_i$  = average heat content for receipts at facility  $i$ ;

$$\text{Weighted Average Btu} = \frac{\sum_i (R_i \times A_i)}{\sum_i R_i},$$

where  $i$  denotes a facility;  $R_i$  = receipts for facility  $i$ ; and,  $A_i$  = average heat content for receipts at facility  $i$ .

The weighted average cost in cents per million Btu is calculated using the following formula:

$$\text{Weighted Average Cost} = \frac{\sum_i (R_i \times A_i \times C_i)}{\sum_i (R_i \times A_i)},$$

where  $i$  denotes a facility;  $R_i$  = receipts for facility  $i$ ;

$A_i$  average heat content for receipts at facility  $i$ ;

and  $C_i$  = cost in cents per million Btu for facility  $i$ .

The weighted average cost in dollars per unit (i.e., tons, barrels, or Mcf) is calculated using the following formula:

$$\text{Weighted Average Cost} = \frac{\sum_i (R_i \times A_i \times C_i)}{10^2 \sum_i R_i},$$

where  $i$  denotes a facility;  $R_i$  = receipts for facility  $i$ ;

$A_i$  = average heat content for receipts at facility  $i$ ;

and,  $C_i$  = cost in cents per million Btu for facility  $i$ .

**Power Production, Fuel Stocks, and Fuel Consumption Data.** The Bureau of Census and the U.S. Geological Survey collected, compiled, and published data on the electric power industry prior to 1936. After 1936, the Federal Power Commission (FPC) assumed all data collection and publication responsibilities for the electric power industry and implemented the Form FPC-4. The Federal Power Act, Section 311 and 312, and FPC Order 141 defined the legislative authority to collect power production data. The Form EIA-759 replaced the Form FPC-4 in January 1982.

In 1996, the Form EIA-900 was initiated to collect sales for resale data from unregulated entities. In 1998, the form was modified to collect sales for resale, gross generation, and sales to end user data. In 1999, the form was modified

to collect net generation, consumption, and ending stock data. In 2000, the form was modified to include the production of useful thermal output data.

In January 2001, Form EIA-906 superseded Forms EIA-759 and EIA-900. In January 2004, Form EIA-920 superseded Form EIA-906 for those plants defined as combined heat and power plants; all other plants that generate electricity continue to report on Form EIA-906. The Federal Energy Administration Act of 1974 (Public Law 93-275) defines the legislative authority to collect these data.

In January 2004, Form EIA-920 superseded Form EIA-906 for those plants defined as combined heat and power plants; all other plants that generate electricity continue to report on Form EIA-906

In January 2008, Form EIA-923 superseded both the EIA-906 and EIA-920 forms for the collection of these data.

**Methodology to Estimate Biogenic and Non-biogenic Municipal Solid Waste.** Municipal Solid Waste (MSW) consumption for generation of electric power is split into its biogenic and non-biogenic components beginning with 2001 data by the following methodology:

The tonnage of MSW consumed is reported on the Form EIA-923. The composition of MSW and categorization of the components were obtained from the Environmental Protection Agency publication, *Municipal Solid Waste in the United States: 2005 Facts and Figures*. The Btu contents of the components of MSW were obtained from various sources<sup>1,4,22,24</sup>.

The potential quantities of combustible MSW discards (which include all MSW material available for combustion with energy recovery, discards to landfill, and other disposal) were multiplied by their respective Btu contents. The EPA-based categories of MSW were then classified into renewable and non-renewable groupings. From this, EIA calculated how much of the energy potentially consumed from MSW was attributed to biogenic components and how much to non-biogenic components (see Table 1 and 2, below)<sup>v</sup>.

These values are used to allocate the net and gross generation published in the *Electric Power Monthly* and *Electric Power Annual* generation tables. The tons of biogenic and non-biogenic components were estimated with the assumption that glass and metals were removed prior to combustion. The average Btu/ton for the biogenic and non-biogenic components is estimated by dividing the total Btu consumption by the total tons. Published net generation attributed to biogenic MSW and non-biogenic MSW is classified under Other Renewables and Other, respectively

<sup>iv</sup> Biogenic components include newsprint, paper, containers and packaging, leather, textiles, yard trimmings, food wastes, and wood. Non-biogenic components include plastics, rubber and other miscellaneous non-biogenic waste.

**Table 1. Btu Consumption for Biogenic and Non-biogenic Municipal Solid Waste (percent)**

	2001	2002	2003	2004	2005	2006
Biogenic	57	56	55	55	56	56
Non-biogenic	43	44	45	45	44	44

**Table 2. Tonnage Consumption for Biogenic and Non-biogenic Municipal Solid Waste (percent)**

	2001	2002	2003	2004	2005	2006
Biogenic	77	77	76	76	75	75
Non-biogenic	23	23	24	24	25	25

**Useful Thermal Output.** With the implementation of the Form EIA-923, "Power Plant Operations Report," in 2008, combined heat and power (CHP) plants are required to report total fuel consumed and electric power generation<sup>v</sup>. Beginning with the January 2008 data, EIA will estimate the allocation of the total fuel consumed at CHP plants between electric power generation and useful thermal output.

First, an efficiency factor is determined for each plant and prime mover type. Based on data for electric power generation and useful thermal output collected in 2003 (on Form EIA-906, "Power Plant Report") efficiency was calculated for each prime mover type at a plant. The efficiency factor is the total output in Btu, including electric power and useful thermal output (UTO), divided by the total input in Btu. Electric power is converted to Btu at 3,412 Btu per kilowatt-hour.

Second, to calculate the amount of fuel for electric power, the gross generation in Btu is multiplied by the efficiency factor. The fuel for UTO is the difference between the total fuel reported and the fuel for electric power generation. UTO is calculated by multiplying the fuel for UTO by the efficiency factor.

In addition, if the total fuel reported is less than the estimated fuel for electric power generation, then the fuel for electric power generation is equal to the total fuel consumed, and the UTO will be zero.

**Conversion of Petroleum Coke to Liquid Petroleum.** The quantity conversion is 5 barrels (of 42 U.S. gallons each) per short ton (2,000 pounds). Coke from petroleum has a heating value of 6.024 million Btus per barrel.

#### **Issues within Historical Data Series.**

##### *Receipts and Cost and Quality of Fossil Fuels*

Values for receipts of natural gas for 2001 forward do not include blast furnace gas or other gas.

Historical data collected on FERC Form 423 and published by EIA have been reviewed for consistency

<sup>v</sup> See the section "Issues within Historical Data Series" for information on the handling of CHP plants prior to 2008.

between volumes and prices and for their consistency over time. However, these data were collected by FERC for regulatory rather than statistical and publication purposes. EIA did not attempt to resolve any late filing issues in the FERC Form 423 data. In 2003, EIA introduced a procedure to estimate for late or non-responding entities due to report on the FERC Form 423. Due to the introduction of this procedure, 2003 and later data cannot be directly compared to previous years' data.

Prior to 2008, regulated plants reported receipts data on the FERC Form 423. These plants, along with unregulated plants, now report receipts data on Schedule 2 of Form EIA-923. Because FERC issued waivers to Form 423 filing requirements to some plants who met certain criteria, and because not all types of generators were required to report (only steam turbines and combined-cycle units reported), a significant number of plants either did not submit fossil fuel receipts data or submitted only a portion of their fossil fuel receipts. Since Form EIA-923 does not have exemptions based on generator type or reporting waivers, receipts data from 2008 and later cannot be directly compared to previous years' data for the regulated sector. Furthermore, there may be a notable increase in fuel receipts beginning with January 2008 data.

Starting with the revised data for 2008, tables for total receipts begin to reflect estimation for all plants with capacity over 1 megawatt, to be consistent with other electric power data. Previous receipts data published have been a legacy of their original collection as information for a regulatory agency, not as a survey to provide more meaningful estimates of totals for statistical purposes. Totals appeared to become smaller as more electric production came from unregulated plants, until the EIA-423 was created to help fill that gap. As a further improvement, estimation of all receipts for the universe normally depicted in the EPM (*i.e.*, 1 megawatt and above), with associated relative standard errors, provides a more complete assessment of the market.

##### *Generation and Consumption*

Beginning in 2008, a new method of allocating fuel consumption between electric power generation and useful thermal output (UTO) was implemented. This new methodology evenly distributes a combined heat and power (CHP) plant's losses between the two output products (electric power and UTO). In the historical data, UTO was consistently assumed to be 80 percent efficient and all other losses at the plant were allocated to electric power. This change causes the fuel for electric power to be decreased while the fuel for UTO is increased as both are given the same efficiency. This results in the appearance of an increase in efficiency of production of electric power between periods.

**Sensitive Data (Formerly identified as Data Confidentiality).** Most of the data collected on the Form EIA-923 are not considered business sensitive. However, the cost of fuel delivered to nonutilities, commodity cost of fossil fuels, and reported fuel stocks at the end of the reporting period are considered business sensitive and

must adhere to EIA's "Policy on the Disclosure of Individually Identifiable Energy Information in the Possession of the EIA" (45Federal Register 59812 (1980)).

## NERC Classification

The Florida Reliability Coordinating Council (FRCC) separated itself from the Southeastern Electric Reliability Council (SERC) in the mid-1990s. In 1998, several utilities realigned from Southwest Power Pool (SPP) to SERC. Name changes altered both the Mid-Continent Area Power Pool (MAPP) to the Midwest Reliability Organization (MRO) and the Western Systems Coordinating Council (WSCC) to the Western Energy Coordinating Council (WECC). The MRO membership boundaries have altered over time, but WECC membership boundaries have not. The utilities in the associated regional entity identified as the Alaska System Coordination Council (ASCC) dropped their formal participation in NERC. Both the States of Alaska and Hawaii are not contiguous with the other continental States and have no electrical interconnections. At the close of calendar year 2005, the follow reliability regional councils were dissolved: East Central Area Reliability Coordinating Agreement (ECAR), Mid-Atlantic Area Council (MAAC), and Mid-America Interconnected Network (MAIN).

On January 1, 2006, the Reliability *First* Corporation (RFC) came into existence as a new regional reliability council. Individual utility membership in the former ECAR, MAAC, and MAIN councils mostly shifted to RFC. However, adjustments in membership as utilities joined or left various reliability councils impacted MRO, SERC, and SPP. The Texas Regional Entity (TRE) was formed from a delegation of authority from NERC to handle the regional responsibilities of the Electric Reliability Council of Texas (ERCOT). The revised delegation agreements covering all the regions were approved by the Federal Energy Regulatory Commission on March 21, 2008. Reliability Councils that are unchanged include: Florida Reliability Coordinating Council (FRCC), Northeast Power Coordinating Council (NPCC), and the Western Energy Coordinating Council (WECC)

The new NERC Regional Council names are as follows:

- Florida Reliability Coordinating Council (FRCC),
- Midwest Reliability Organization (MRO),
- Northeast Power Coordinating Council (NPCC),
- Reliability *First* Corporation (RFC),
- Southeastern Electric Reliability Council (SERC),
- Southwest Power Pool (SPP),
- Texas Regional Entity (TRE), and
- Western Energy Coordinating Council (WECC).

## Business Classification

Nonutility power producers consist of corporations, persons, agencies, authorities, or other legal entities that own or operate facilities for electric generation but are not electric utilities. This includes qualifying cogenerators, small power producer, and independent power producers. Furthermore, nonutility power producers do not have a designated franchised service area. In addition to entities whose primary business is the production and sale of electric power, entities with other primary business classifications can and do sell electric power. These can consist of manufacturing, agricultural, forestry, transportation, finance, service and administrative industries, based on the Office of Management and Budget's Standard Industrial Classification (SIC) Manual.<sup>17</sup> In 1997, the SIC Manual name was changed to North American Industry Classification System (NAICS). The following is a list of the main classifications and the category of primary business activity within each classification.

### Agriculture, Forestry, and Fishing

- 111 Agriculture production-crops
- 112 Agriculture production, livestock and animal specialties
- 113 Forestry
- 114 Fishing, hunting, and trapping
- 115 Agricultural services

### Mining

- 211 Oil and gas extraction
- 2121 Coal mining
- 2122 Metal mining
- 2123 Mining and quarrying of nonmetallic minerals except fuels

### Construction

23

### Manufacturing

- 311 Food and kindred products
- 3122 Tobacco products
- 314 Textile and mill products
- 315 Apparel and other finished products made from fabrics and similar materials
- 316 Leather and leather products
- 321 Lumber and wood products, except furniture
- 322 Paper and allied products (other than 322122 or 32213)
- 322122 Paper mills, except building paper
- 32213 Paperboard mills
- 323 Printing and publishing
- 324 Petroleum refining and related industries (other than 32411)
- 32411 Petroleum refining
- 325 Chemicals and allied products (other than 325188, 325211, 32512, or 325311)
- 32512 Industrial organic chemicals
- 325188 Industrial Inorganic Chemicals

325211 Plastics materials and resins  
 325311 Nitrogenous fertilizers  
 326 Rubber and miscellaneous plastic products  
 327 Stone, clay, glass, and concrete products (other than 32731)  
 32731 Cement, hydraulic  
 331 Primary metal industries (other than 331111 or 331312)  
 331111 Blast furnaces and steel mills  
 331312 Primary aluminum  
 332 Fabricated metal products, except machinery and transportation equipment  
 333 Industrial and commercial equipment and components except computer equipment  
 3345 Measuring, analyzing, and controlling instruments, photographic, medical, and optical goods, watches and clocks  
 335 Electronic and other electrical equipment and components except computer equipment  
 336 Transportation equipment  
 337 Furniture and fixtures  
 339 Miscellaneous manufacturing industries

**Transportation and Public Utilities**

22 Electric, gas, and sanitary services  
 2212 Natural gas transmission  
 2213 Water supply  
 22131 Irrigation systems  
 22132 Sewerage systems  
 481 Transportation by air  
 482 Railroad transportation  
 483 Water transportation  
 484 Motor freight transportation and warehousing  
 485 Local and suburban transit and interurban highway passenger transport  
 486 Pipelines, except natural gas  
 487 Transportation services  
 491 United States Postal Service  
 513 Communications  
 562212 Refuse systems

**Wholesale Trade**

421 to 422

**Retail Trade**

441 to 454

**Finance, Insurance, and Real Estate**

521 to 533

**Services**

512 Motion pictures  
 514 Business services  
 514199 Miscellaneous services  
 541 Legal services  
 561 Engineering, accounting, research, management, and related services  
 611 Education services  
 622 Health services  
 624 Social services  
 712 Museums, art galleries, and botanical and zoological gardens  
 713 Amusement and recreation services  
 721 Hotels  
 811 Miscellaneous repair services  
 8111 Automotive repair, services, and parking  
 812 Personal services  
 813 Membership organizations  
 814 Private households

**Public Administration**

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**Table C1. Average Heat Content of Fossil-Fuel Receipts, August 2009**

Census Division and State	Coal (Million Btu per Ton) <sup>1</sup>	Petroleum Liquids (Million Btu per Barrel) <sup>2</sup>	Petroleum Coke (Million Btu per Ton)	Natural Gas (Million Btu per Thousand Cubic Feet) <sup>3</sup>
<b>New England</b> .....	<b>24.00</b>	<b>6.06</b>	--	<b>1.02</b>
Connecticut .....	25.25	5.89	--	1.01
Maine.....	25.44	6.11	--	1.04
Massachusetts.....	23.34	6.08	--	1.03
New Hampshire.....	26.00	6.01	--	1.03
Rhode Island.....	--	6.08	--	1.00
Vermont.....	--	5.65	--	1.00
<b>Middle Atlantic</b> .....	<b>21.91</b>	<b>6.09</b>	<b>28.05</b>	<b>1.02</b>
New Jersey.....	22.29	5.91	--	1.03
New York.....	22.25	6.13	28.00	1.02
Pennsylvania.....	21.85	5.95	28.29	1.03
<b>East North Central</b> .....	<b>20.10</b>	<b>5.92</b>	<b>28.17</b>	<b>1.01</b>
Illinois.....	17.72	5.76	--	1.01
Indiana.....	20.99	5.78	--	1.01
Michigan.....	20.08	5.94	28.00	1.01
Ohio.....	23.47	5.83	28.29	1.03
Wisconsin.....	18.02	6.19	28.23	1.01
<b>West North Central</b> .....	<b>16.71</b>	<b>5.83</b>	<b>29.30</b>	<b>1.01</b>
Iowa.....	17.33	5.76	28.29	1.01
Kansas.....	17.11	5.81	29.53	1.02
Minnesota.....	17.75	5.85	--	1.01
Missouri.....	17.59	5.78	29.54	1.02
Nebraska.....	17.09	5.83	--	.99
North Dakota.....	13.18	5.90	--	1.02
South Dakota.....	16.85	5.82	--	1.00
<b>South Atlantic</b> .....	<b>23.99</b>	<b>6.26</b>	<b>28.05</b>	<b>1.03</b>
Delaware.....	25.00	5.81	--	1.02
District of Columbia.....	--	5.77	--	--
Florida.....	23.92	6.31	27.99	1.02
Georgia.....	22.01	6.08	28.55	1.04
Maryland.....	25.24	5.95	--	1.04
North Carolina.....	24.74	6.25	--	1.03
South Carolina.....	24.86	6.17	--	1.03
Virginia.....	25.06	6.31	--	1.04
West Virginia.....	24.25	5.81	--	1.04
<b>East South Central</b> .....	<b>21.75</b>	<b>5.88</b>	<b>28.33</b>	<b>1.02</b>
Alabama.....	21.09	5.79	--	1.02
Kentucky.....	23.11	5.80	28.33	1.02
Mississippi.....	17.38	5.90	--	1.02
Tennessee.....	22.14	6.05	--	1.03
<b>West South Central</b> .....	<b>16.15</b>	<b>6.17</b>	<b>28.67</b>	<b>1.02</b>
Arkansas.....	17.41	6.00	--	1.02
Louisiana.....	16.27	6.24	28.71	1.03
Oklahoma.....	17.38	6.31	--	1.04
Texas.....	15.64	6.14	28.61	1.02
<b>Mountain</b> .....	<b>19.42</b>	<b>5.74</b>	<b>29.05</b>	<b>1.03</b>
Arizona.....	19.59	5.82	--	1.02
Colorado.....	19.80	5.07	--	1.03
Idaho.....	22.39	5.82	--	1.02
Montana.....	16.83	5.90	29.05	1.02
Nevada.....	21.16	5.81	--	1.03
New Mexico.....	18.71	5.66	--	1.04
Utah.....	22.24	5.88	--	1.04
Wyoming.....	17.66	5.93	--	.98
<b>Pacific Contiguous</b> .....	<b>18.45</b>	<b>5.44</b>	<b>28.87</b>	<b>1.03</b>
California.....	23.98	4.74	28.87	1.03
Oregon.....	16.82	5.89	--	1.02
Washington.....	16.85	6.00	--	1.03
<b>Pacific Noncontiguous</b> .....	<b>19.29</b>	<b>6.06</b>	--	<b>1.02</b>
Alaska.....	17.40	5.46	--	1.02
Hawaii.....	20.92	6.12	--	--
<b>U.S. Total</b> .....	<b>19.87</b>	<b>6.13</b>	<b>28.34</b>	<b>1.02</b>

<sup>1</sup> Anthracite, bituminous, subbituminous, lignite, waste coal and coal synfuel.

<sup>2</sup> Includes distillate fuel oil, residual fuel oil, jet fuel, kerosene, and waste oil.

<sup>3</sup> Natural gas includes a small amount of supplemental gaseous fuels.

Notes: • Due to different reporting requirements between the Form EIA-923 and historical FERC Form 423, the receipts data from 2008 and on are not directly comparable to prior years. For more information, please see the Technical Notes in Appendix C. • See Glossary for definitions. • Values for 2009 are preliminary. • Data represent weighted values.

Source: Energy Information Administration, Form EIA-923, "Power Plant Operations Report."

**Table C2. Comparison of Preliminary Monthly Data Versus Final Monthly Data at the U.S. Level, 2005 Through 2007**

Item	Mean Absolute Value of Change (Percent) Total (All Sectors)		
	2005	2006	2007
<b>Net Generation</b>			
Coal <sup>1</sup> .....	.09	.17	.20
Petroleum Liquids <sup>2</sup> .....	.60	2.78	1.29
Petroleum Coke.....	4.36	1.02	3.16
Natural Gas <sup>3</sup> .....	1.38	1.29	.69
Other Gases.....	13.52	11.24	12.61
Hydroelectric <sup>4</sup> .....	2.02	1.51	.46
Nuclear.....	.20	--	.01
Other <sup>5</sup> .....	4.59	1.03	2.25
<b>Total.....</b>	<b>.42</b>	<b>.29</b>	<b>.17</b>
<b>Consumption of Fossil Fuels for Electric Generation</b>			
Coal <sup>1</sup> .....	.93	.48	.62
Petroleum Liquids <sup>2</sup> .....	4.54	2.73	5.15
Petroleum Coke.....	3.18	3.56	2.96
Natural Gas <sup>3</sup> .....	7.03	6.18	5.80
<b>Fuel Stocks<sup>6</sup></b>			
Coal <sup>1</sup> .....	.16	.65	.85
Petroleum Liquids <sup>2</sup> .....	--	--	--
Petroleum Coke.....	--	--	--
<b>Retail Sales</b>			
Residential.....	5.50	2.39	.50
Commercial <sup>7</sup> .....	9.18	3.76	3.16
Industrial <sup>7</sup> .....	2.86	11.47	19.96
Transportation <sup>7</sup> .....	111.01	107.71	12.40
<b>Total.....</b>	<b>2.50</b>	<b>1.99</b>	<b>4.35</b>
<b>Revenue</b>			
Residential <sup>7</sup> .....	3.87	2.32	2.60
Commercial <sup>7</sup> .....	2.44	11.93	8.01
Industrial.....	33.15	25.53	32.57
Transportation <sup>7</sup> .....	58.37	49.90	43.53
<b>Total.....</b>	<b>6.19</b>	<b>8.31</b>	<b>3.95</b>
<b>Average Retail Price</b>			
Residential.....	2.43	1.78	2.66
Commercial <sup>7</sup> .....	6.60	12.85	5.14
Industrial <sup>7</sup> .....	35.80	14.07	12.45
Transportation <sup>7</sup> .....	186.74	63.70	46.57
<b>Total.....</b>	<b>6.12</b>	<b>6.90</b>	<b>1.23</b>
<b>Receipts of Fossil Fuels</b>			
Coal <sup>1</sup> .....	.07	.31	.22
Petroleum Liquids <sup>2</sup> .....	.31	.39	1.70
Petroleum Coke.....	.36	.22	.44
Natural Gas <sup>3</sup> .....	.38	.09	.13
<b>Cost of Fossil Fuels<sup>8</sup></b>			
Coal <sup>1</sup> .....	.06	.02	.04
Petroleum Liquids <sup>2</sup> .....	.13	.14	.36
Petroleum Coke.....	.37	.29	.23
Natural Gas <sup>3</sup> .....	.04	.03	.02

<sup>1</sup> Anthracite, bituminous, subbituminous, lignite, waste coal, and synthetic coal. Coal stocks exclude waste coal.

<sup>2</sup> Distillate fuel oil, residual fuel oil, jet fuel, kerosene, and waste oil. In 2004 petroleum stocks exclude waste oil.

<sup>3</sup> Natural gas includes a small amount of supplemental gaseous fuels that cannot be identified separately. Excludes blast furnace gas and other gases.

<sup>4</sup> Includes conventional hydroelectric and hydroelectric pumped storage facilities.

<sup>5</sup> Includes geothermal, wood, waste, wind, and solar, batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, and miscellaneous technologies.

<sup>6</sup> Stocks are end-of-month values.

<sup>7</sup> See technical notes (<http://www.eia.doe.gov/cneaf/electricity/epm/appenc.pdf>) for additional information on the Commercial, Industrial and Transportation sectors.

<sup>8</sup> Data represent weighted values.

Notes: • Change refers to the difference between estimates or preliminary monthly data published in the Electric Power Monthly (EPM) and the final monthly data published in the EPM. • Values for 2007 are final.

Sources: • Energy Information Administration, Form EIA-423, "Monthly Cost and Quality of Fuels for Electric Plants Report;" Energy Information Administration, Form EIA-826, "Monthly Electric Sales and Revenue With State Distributions Report;" Form EIA-906, "Power Plant Report;" Energy Information Administration, Form EIA-920 "Combined Heat and Power Plant Report;" and Federal Energy Regulatory Commission, FERC Form 423, "Monthly Report of Cost and Quality of Fuels for Electric Plants."

**Table C3. Comparison of Annual Monthly Estimates Versus Annual Data at the U.S. Level, All Sectors 2005 Through 2007**

Item	2005			2006			2007		
	Annual Monthly Estimates	Annual Final	Change (percent)	Annual Monthly Estimates	Annual Final	Change (percent)	Annual Monthly Estimates	Annual Final	Change (Percent)
<b>Net Generation (thousand megawatthours)</b>									
Coal <sup>1</sup> .....	2,014,173	2,012,873	-1	1,987,224	1,990,511	.2	2,020,572	2,016,456	-2
Petroleum Liquids <sup>2</sup> .....	100,282	99,840	-4	43,343	44,460	2.6	49,956	49,505	-9
Petroleum Coke.....	21,628	22,385	3.5	19,861	19,706	-8	15,752	16,234	3.1
Natural Gas <sup>3</sup> .....	751,549	760,960	1.3	807,597	816,441	1.1	893,211	896,590	.4
Other Gases.....	15,644	13,464	-13.9	15,970	14,177	-11.2	15,414	13,453	-12.7
Hydroelectric <sup>4</sup> .....	258,510	263,763	2.0	281,397	282,689	.5	241,319	240,614	-.3
Nuclear.....	780,465	781,986	.2	787,219	787,219	--	806,487	806,425	*
Other <sup>5</sup> .....	95,739	100,150	4.6	110,358	109,500	-8	116,803	117,469	.6
<b>Total.....</b>	<b>4,037,989</b>	<b>4,055,423</b>	<b>.4</b>	<b>4,052,968</b>	<b>4,064,702</b>	<b>.3</b>	<b>4,159,514</b>	<b>4,156,745</b>	<b>-.1</b>
<b>Consumption of Fossil Fuels for Electric Generation</b>									
Coal (1,000 tons) <sup>1</sup> .....	1,051,177	1,041,448	-9	1,035,469	1,030,556	-5	1,053,346	1,046,795	-6
Petroleum Liquids (1,000 barrels) <sup>2</sup> .....	172,407	165,137	-4.2	75,634	73,821	-2.4	87,005	82,433	-5.3
Petroleum Coke (1,000 tons).....	8,510	8,330	-2.1	7,634	7,363	-3.6	6,222	6,036	-3.0
Natural Gas (1,000 Mcf) <sup>3</sup> .....	6,465,972	6,036,370	-6.6	6,878,086	6,461,615	-6.1	7,507,446	7,089,342	-5.6
<b>Fuel Stocks for Electric Power Sector<sup>6</sup></b>									
Coal (1,000 tons) <sup>1</sup> .....	101,237	101,137	-1	139,679	140,964	.9	151,127	151,221	.1
Petroleum Liquids (1,000 barrels) <sup>2</sup> .....	48,274	47,414	-1.8	49,189	48,216	-2.0	42,984	44,433	3.4
Petroleum Coke (1,000 tons).....	531	530	-.3	704	674	-4.3	550	554	.7
<b>Retail Sales (Million kWh)</b>									
Residential.....	1,364,788	1,359,227	-.4	1,354,232	1,351,520	-.2	1,391,911	1,391,807	*
Commercial <sup>7</sup> .....	1,265,155	1,275,079	.8	1,300,851	1,299,744	-.1	1,342,673	1,339,596	-.2
Industrial <sup>7</sup> .....	1,021,313	1,019,156	-.2	1,001,929	1,011,298	.9	1,005,828	1,022,567	1.7
Transportation <sup>7</sup> .....	8,271	7,506	-9.3	8,086	7,358	-9.0	7,738	7,724	-.2
<b>Total.....</b>	<b>3,659,527</b>	<b>3,660,969</b>	<b>*</b>	<b>3,665,099</b>	<b>3,669,919</b>	<b>.1</b>	<b>3,748,149</b>	<b>3,761,695</b>	<b>.4</b>
<b>Retail Revenue (Million Dollars)</b>									
Residential.....	128,666	128,393	-.2	140,838	140,582	-.2	148,027	148,299	.2
Commercial <sup>7</sup> .....	110,287	110,522	.2	121,728	122,914	1.0	129,765	128,899	-.7
Industrial <sup>7</sup> .....	56,867	58,445	2.8	61,010	62,308	2.1	63,972	65,712	2.7
Transportation <sup>7</sup> .....	613	643	4.9	732	702	-4.1	805	793	-1.5
<b>Total.....</b>	<b>296,434</b>	<b>298,003</b>	<b>.5</b>	<b>324,308</b>	<b>326,506</b>	<b>.7</b>	<b>342,569</b>	<b>343,703</b>	<b>.3</b>
<b>Average Retail Price (Cents/kWh)</b>									
Residential.....	9.43	9.45	.2	10.40	10.40	--	10.64	10.66	.2
Commercial <sup>7</sup> .....	8.72	8.67	-.6	9.36	9.46	1.1	9.67	9.62	-.5
Industrial <sup>7</sup> .....	5.57	5.73	2.9	6.09	6.16	1.2	6.36	6.43	1.1
Transportation <sup>7</sup> .....	7.42	8.57	15.5	9.06	9.54	5.3	10.40	10.26	-1.4
<b>Total.....</b>	<b>8.10</b>	<b>8.14</b>	<b>.5</b>	<b>8.85</b>	<b>8.90</b>	<b>.6</b>	<b>9.14</b>	<b>9.14</b>	<b>--</b>
<b>Receipts of Fossil Fuels</b>									
Coal (1,000 tons) <sup>1</sup> .....	1,026,185	1,021,437	-5	1,052,605	1,079,943	2.6	1,072,997	1,054,664	-1.7
Petroleum Liquids (1,000 barrels) <sup>2</sup> .....	154,902	157,221	1.5	65,771	65,002	-1.2	69,524	60,068	-13.6
Petroleum Coke (1,000 tons).....	7,519	7,502	-.2	7,256	7,193	-.9	5,784	5,656	-2.2
Natural Gas (1,000 Mcf) <sup>3</sup> .....	5,984,524	6,181,717	3.3	6,691,179	6,675,246	-.2	7,291,211	7,200,316	-1.3
<b>Cost of Fossil Fuels (Dollars per million Btu)<sup>8</sup></b>									
Coal <sup>1</sup> .....	1.54	1.54	--	1.69	1.69	--	1.78	1.77	-.6
Petroleum Liquids <sup>2</sup> .....	7.65	7.59	-.8	8.72	8.68	-.5	9.62	9.59	-.3
Petroleum Coke.....	1.12	1.11	-.9	1.30	1.33	2.3	1.54	1.51	-2.0
Natural Gas <sup>3</sup> .....	8.20	8.21	.1	6.92	6.94	.3	7.10	7.11	.1

<sup>1</sup> Anthracite, bituminous, subbituminous, lignite, waste coal, and synthetic coal. Coal stocks exclude waste coal.

<sup>2</sup> Distillate fuel oil, residual fuel oil, jet fuel, kerosene, and waste oil. In 2004 petroleum stocks exclude waste oil.

<sup>3</sup> Natural gas includes a small amount of supplemental gaseous fuels that cannot be identified separately. Excludes blast furnace gas and other gases.

<sup>4</sup> Includes conventional hydroelectric and hydroelectric pumped storage facilities.

<sup>5</sup> Includes geothermal, wood, waste, wind, and solar, batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, and miscellaneous technologies.

<sup>6</sup> Stocks are end-of-month values.

<sup>7</sup> See technical notes (<http://www.eia.doe.gov/cneaf/electricity/epm/appenc.pdf>) for additional information on the Commercial, Industrial and Transportation sectors.

<sup>8</sup> Data represent weighted values.

\* = Value is less than 0.05.

Notes: • The average revenue per kilowatthour is calculated by dividing revenue by sales. • Mean absolute value of change is the unweighted average of the absolute changes. • Totals may not equal sum of components because of independent rounding.

Sources: Energy Information Administration, Form EIA-900, "Monthly Nonutility Power Report;" Form EIA-867, "Annual Nonutility Power Producer Report;" Form EIA-759, "Monthly Power Plant Report;" Form EIA-861, "Annual Electric Utility Report;" and Form EIA-826, "Monthly Electric Utility Sales and Revenue Report with State Distributions."

**Table C4. Unit-of-Measure Equivalents for Electricity**

Unit	Equivalent
Kilowatt (kW).....	1,000 (One Thousand) Watts
Megawatt (MW).....	1,000,000 (One Million) Watts
Gigawatt (GW).....	1,000,000,000 (One Billion) Watts
Terawatt (TW).....	1,000,000,000,000 (One Trillion) Watts
Gigawatt.....	1,000,000 (One Million) Kilowatts
Thousand Gigawatts.....	1,000,000,000 (One Billion) Kilowatts
Kilowatthours (kWh).....	1,000 (One Thousand) Watthours
Megawatthours (MWh).....	1,000,000 (One Million) Watthours
Gigawatthours (GWh).....	1,000,000,000 (One Billion) Watthours
Terawatthours (TWh).....	1,000,000,000,000 (One Trillion) Watthours
Gigawatthours.....	1,000,000 (One Million) Kilowatthours
Thousand Gigawatthours.....	1,000,000,000 (One Billion) Kilowatthours

Source: Energy Information Administration.