



*Independent Statistics & Analysis*

U.S. Energy Information  
Administration

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# A Guide to EIA Electric Power Data

March 2018



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## Introduction

The U.S. Energy Information Administration (EIA) collects a wide range of data on the electric power industry in the United States. Because of the regulatory history of the electric power industry, EIA's electric power data are almost entirely non-confidential. This guide describes the data that EIA collects and how the data are made available to the public.

The guide is presented in four major sections:

**I. Published Aggregate Data:** This section discusses EIA's publications of aggregated electricity data.

**II. Description of Electricity Data that EIA Collects, Estimates, and Forecasts:** This section describes the major types of electricity data that EIA collects, estimates, and forecasts and where EIA publishes the data. The data include:

- Information about electric power plants, including
  - Power plant characteristics (Form EIA-860)
  - Power plant operations (Form EIA-923)
  - Power plant environmental controls and estimated emissions
- Retail sales by utilities and power marketers (Form EIA-861)
- Estimates of electricity generation from small-scale solar PV installations
- Electricity imports and exports with Canada and Mexico (Form EIA-111)
- Reliability information about the electricity supply (Form EIA-411)
- Hourly electricity demand, demand forecast, net generation, and the interchange between electricity systems (Form EIA-930)
- Forecasts of the future of the electricity industry

These sources include hundreds of data elements. For a complete list and explanation of all the data items collected, see the electric power survey forms and instructions, available on EIA's website at <https://www.eia.gov/survey/#electricity>.

**III. EIA Electricity Data Resources:** This section describes information resources that EIA provides to the public to facilitate access to and understanding of the data. These resources include:

- Detailed data files in Excel format
- Web applications that allow the public to interact with and visualize EIA's electricity data
- Wholesale daily electricity price index data for selected price hubs
- *Today In Energy*, daily articles and graphs on the EIA homepage
- Social media platforms, including YouTube, Facebook, and Twitter

The web pages that report these data include explanations of the file layouts and contents for current and historical data. In some cases, these descriptions are in the zip folders that contain the downloadable data sets.

**IV. Imputation (Estimation) Used by Electricity Surveys:** The final section describes EIA's use of statistical imputation in the context of its electricity surveys.

## I. Published Aggregate Data

We publish aggregate data in the following electricity-specific products on our website in four reports:

- *Electricity Monthly Update* (EMU) (<https://www.eia.gov/electricity/monthly/update/>). Archived versions of the EMU and its predecessor publication, the monthly *Flash Estimate*, are available back to February 2005 (containing December 2004 data).
- *Electric Power Monthly* (EPM) (<https://www.eia.gov/electricity/monthly/>). Archived versions of the EPM are available back to June 1996 (containing March 1996 data). Versions before May 2003 are only available as PDF files.
- *Electric Power Annual* (EPA) (<https://www.eia.gov/electricity/annual/>). Archived versions of the EPA are available back to 1994. Versions before 2009 are only available as PDF files.
- *State Electricity Profiles* (<https://www.eia.gov/electricity/state/>).

Aggregate electric power data are also included in the EIA products that cover other energy sources:

- *Monthly Energy Review* (<https://www.eia.gov/totalenergy/data/monthly/>) and the now-discontinued *Annual Energy Review* (<https://www.eia.gov/totalenergy/data/annual/>)
- *State Energy Data System* (<https://www.eia.gov/state/seds/seds-data-complete.php?sid=US>)
- *State Energy Portal* (<https://www.eia.gov/state/>)

EIA also publishes aggregated data in more narrowly focused publications that are discussed in more detail in the section **Description of Electricity Data that EIA Collects, Estimates, and Forecasts**.

## II. Description of Electricity Data that EIA Collects, Estimates, and Forecasts

### Electric Power Plants

EIA collects information about electric power plants through two annual surveys (Form EIA-860, *Annual Electric Generator Report*, and Form EIA-923, *Power Plant Operations Report*) that have monthly supplements. Data for the supplements are collected from a subset of power plants. These surveys are described in the sub-sections, **Power Plant Characteristics (Form EIA-860, *Annual Electric Generator Report*)** and **Power Plant Operations (Form EIA-923, *Power Plant Operations Report*)**, below. For reporting purposes U.S. power plants are categorized into seven sectors described in the sub-section **Industry Characterization Used by EIA**. Because EIA does not collect complete information from every power plant every month, we use statistical imputation to estimate monthly operational characteristics of the electric industry. EIA's use of imputation is described in the section **Use of Imputation (Estimation)** at the end of this guide.

Historically, EIA has collected U.S. electric power plant data for the 50 states and the District of Columbia. In data year 2017, EIA began collecting electric power plant data for the Commonwealth of Puerto Rico. However, as of this writing, the data for Puerto Rico are incomplete, largely because of disruptions caused by the 2017 hurricane.

## **Power Plant Characteristics (Form EIA-860, Annual Electric Generator Report)**

### ***Data Collected by Form EIA-860***

The Form EIA-860 survey collects a wide range of data about the characteristics of electric power plants and the equipment found at those electric power plants.

The data are intended to constitute a complete inventory of electric generating units located at facilities with a minimum on-site nameplate capacity of one megawatt (MW). The data collected include:

- The location (state, county, balancing authority, latitude and longitude) of a power plant
- The ownership of generating units (including designations of joint ownership)
- The capacity and energy source used by each generating unit at the plant
- The status of the plant as of December 31 of the reporting year (e.g., operational, standby, or retired)
- For steam electric plants, individual boiler characteristics, cooling-water systems, and emission control systems in non-nuclear plants (see a description in sub section **Power Plant Environmental Controls and Estimated Emissions**)

In addition to collecting data on existing generating units, EIA also collects data on proposed plants and plants under construction. To be included, the plant must be scheduled for commercial operation within 10 years for coal and nuclear plants and within 5 years for all other types of plants.

For a complete guide to the data collected, see the instructions for Form EIA-860, *Annual Electric Generator Report*, and Form EIA-860M, *Monthly Update to the Annual Electric Generator Report*. The instructions and survey forms are available on our website at <https://www.eia.gov/survey/#eia-860> and <https://www.eia.gov/survey/#eia-860m>.

### ***Where to Find Form EIA-860 Data***

**Annual Detailed Data Files:** Detailed Excel files that report the data we collect on the annual Form EIA-860 are available at <https://www.eia.gov/electricity/data/eia860/>. All data collected on the form except two confidential items (tested heat rates and the construction cost of new generating units) are reported in these data files. Data files are available from 1990 to the most current year. However, users should be aware that the data items we collect change over time. The data are most consistent, and of the highest quality for the period beginning with the 2002 data. Coverage of non-utility generating units, such as units located at industrial sites, is spotty before the 2002 data file.

The annual data files include information for all surveyed units, including retired units. Note that the lists of retired and canceled units are not comprehensive and only include facilities that were surveyed in the current year. If a respondent's last operating unit retires, then the respondent is no longer required to complete the annual Form EIA-860 survey, and its retired units will not be listed in the annual detailed data files in subsequent years. A more comprehensive list of retired and canceled units is available in the **Monthly Detailed Data Files** described below.

**Monthly Detailed Data Files:** All of the data collected on the monthly Form EIA-860M survey are reported in a single monthly Excel file on our website at <https://www.eia.gov/electricity/data/eia860m>. This file lists the complete inventory of generating units in the United States in four categories:

- Operational units
- Planned units, including units under construction
- Retired units
- Planned units that have been canceled or postponed

Note that the lists of retired and canceled/postponed units are not complete – units that were retired before 2002 are generally not included in the data files.

Data in these monthly files begin in July 2015.

**Aggregated Data Files:** Aggregated data from Form EIA-860 and Form EIA-860M are published in several locations:

- The *Electric Power Monthly* (<https://www.eia.gov/electricity/monthly/>) publishes aggregated capacity data.
- The *Electric Power Annual* (<https://www.eia.gov/electricity/annual/>) publishes aggregated capacity data, aggregated information about environmental control equipment, aggregated information about fuel-switching capabilities, and aggregated tested heat rates by energy source. (Note that the tested heat rate of a generating unit is business sensitive and is not available in the detailed data files; it is only available at the aggregate level.)
- The construction cost of new generating units is a business sensitive element, which is only available at the aggregate level at <https://www.eia.gov/electricity/generatorcosts/>. These cost data are available beginning in 2013.

### **Power Plant Operations (Form EIA-923, Power Plant Operations Report)**

#### ***Data Collected by Form EIA-923***

The Form EIA-923 survey collects a wide range of data about the operations of electric power plants:

- Electricity generation
- Fuel consumption
- Fossil fuel stocks
- Fuel deliveries, including quantity, supplier, the specific mine for coal deliveries, and quality characteristics such as heat content
- Environmental-related operating data for steam electric plants (see the sub section **Power Plant Environmental Controls and Estimated Emissions** for a detailed description)

The frequency and scope of the data collected depend in part on plant size. In general, data are collected monthly for larger plants and annually for smaller plants.

In some cases operating data are reported at the generating-unit level, but in other cases data are reported at an aggregate level for all units at a plant with the same fuel type.

Specific reporting requirements are described in the form instructions.

EIA's data collection surveys and the data elements collected have changed over time. For the current data collection, see the form and instructions for the Form EIA-923 survey at <https://www.eia.gov/survey/#eia-923>. For earlier years, you can find data at

- The explanatory text on our website at: <https://www.eia.gov/electricity/data/eia923/>
- The guide to survey data (called the *layout file*) that accompanies the data files

### **Where to Find Form EIA-923 Data**

**Detailed Data Files:** The data collected on power plant operations can be divided into three broad categories: electricity generation and fuel consumption data; fuel receipts, cost, and quality data; and environmental data. A complication with using the data is that the survey instruments and format of the data files have changed over time, going back to the period when the data were collected by the Federal Power Commission (FPC).

- **Electricity Generation and Fuel Consumption Data Files:** These data are available from 1970 forward at <https://www.eia.gov/electricity/data/eia923/>. Data users should be aware of some limitations:
  - EIA did not begin systematically collecting and reporting data on non-utility generating units until 2001.
  - Prime mover codes are not included in the 2001 and 2002 data files.
  - Plant codes (i.e., plant ID numbers) for earlier data files, such as those from the 1970s, may not be consistent with current codes for the same plants.
- **Fuel Receipts, Cost, and Quality Data Files:** This information was collected by the Federal Energy Regulatory Commission (FERC) and its predecessor, the Federal Power Commission (FPC), beginning in 1972 from power plants operated by regulated utilities. Beginning in 2002, EIA supplemented the FERC survey of utility plant data with a survey of non-utility plants. In 2008, these separate data collections were unified into a single EIA survey. You can find these files on our website:
  - Combined data files (utility and non-utility plant) from 2008 forward: <https://www.eia.gov/electricity/data/eia923/>
  - EIA collection of non-utility data, 2002 to 2007: <https://www.eia.gov/electricity/data/eia423/>
  - Utility data collected by FERC and the Federal Power Commission, 1972 to 2007: <https://www.eia.gov/electricity/data/eia423/>

Users should see the text files and the CORDANT.xls files included in the .zip files for 1993–2001.

- **Environmental Data Files:** EIA collects environmental information about electric power plants from a variety of sources and combines them in published data files. These environmental data files are discussed in the next sub section, **Power Plant Environmental Controls and Estimated Emissions**.

**Aggregated Data Files:** Aggregated data from Form EIA-923 are published in several locations:

- The *Electric Monthly Update* (<https://www.eia.gov/electricity/monthly/update/>)

- The *Electric Power Monthly* (<https://www.eia.gov/electricity/monthly/>)
- The *Electric Power Annual* (<https://www.eia.gov/electricity/annual/>)

## *Power Plant Environmental Controls and Estimated Emissions*

### **Data Collected about Environmental Controls and Emissions**

The Form EIA-860 and Form EIA-923 surveys collect information about electric power plant environmental controls. However, because EIA collected this information from different sources in the past, EIA reports the history of environmental controls in different locations.

This section describes the data EIA collects about electric power plant environmental controls and where EIA reports that data on its website for various historical periods. EIA collects three types of information: characteristics of the air-emission systems and cooling-water systems at electric power plants, the operations of these systems, and combustion residuals produced by fossil fuel-fired plants.

In 2010, EIA began collaborating with the United States Geological Survey to improve government water data, including the cooling-water data EIA collects. EIA made changes to its procedures and surveys to improve the cooling-water data we collect. These data are most reliable beginning in 2014.

### **Where to Find the Data about Environmental Controls and Emissions**

**Detailed Data Files:** The detailed data files are published in several locations on our website, depending on when the data were collected.

For the period 2007 to most current, the environmental equipment characteristics data have been part of the larger set of generating unit capacity data: <https://www.eia.gov/electricity/data/eia860/>.

For the same period, the environmental equipment operating data, including the information on combustion residuals, have been part of the larger set of power plant operating information: <https://www.eia.gov/electricity/data/eia923/>.

For the period 1985 through 2005, the environmental equipment characteristics and operating data are stored together in a single zip file for each year: <https://www.eia.gov/electricity/data/eia767/>.

Environmental data were collected by EIA before 1985, but this information is not available in electronic form. Lack of funding resulted in no environmental data being collected for the year 2006.

Environmental data collected by the Federal Power Commission for the years 1969–1973 are available from the Internet Archive. For example, the 1969 report is available on the internet at <https://archive.org/details/steamelectricpla1969unit>.

**Estimated Plant-Level Emissions Files:** EIA creates annual estimates of air emissions from power plants. These estimates for the period 2013 to the most current period are available on our website at <https://www.eia.gov/electricity/data/emissions/>.

**Combined Cooling System Data Files:** The relationship between a plant's cooling systems and its generating units and boilers can be complex, which makes the data difficult to organize and link with



other data fields, such as fuel consumption. Files with these linkages for 2014 to the most current period are available on our website at <https://www.eia.gov/electricity/data/water/>.

**Aggregated Data Files:** Some aggregated environmental data are published in the *Electric Power Annual* at <https://www.eia.gov/electricity/annual/>.

### *Industry Characterization of Electric Power Plants*

EIA categorizes electric power plants into seven industry sectors for reporting purposes:

Sector 1. Electric Utility: Traditional regulated electric utilities (investor-owned utilities, municipal-owned utilities, cooperatives, state-owned utilities, and federally-owned utilities)

Sector 2. Independent power producers that are not combined heat and power (CHP) plants

Sector 3. Independent power producers that are CHP plants, but whose primary business purpose is the sale of electricity

Sector 4. Commercial non-CHP facilities that produce electric power, that are connected to the grid, and that can sell power to the public

Sector 5. Commercial CHP facilities that produce electric power, that are connected to the grid, and that can sell power to the public

Sector 6. Industrial non-CHP facilities that produce electric power, that are connected to the grid, and that can sell power to the public

Sector 7. Industrial CHP facilities that produce electric power, that are connected to the grid, and that can sell power to the public

The combination of all seven sectors is referred to as the *Electric Power Industry*. Sectors 1, 2, and 3 constitute the *Electric Power Sector*, which is the part of the electric power industry that produces and sells electricity as its primary business.

These seven sectors characterize the power-generation side of the electricity business. A different set of business sectors is used to characterize the utilities and other entities involved in the retail sale of electricity.

## **Retail Sales by Electric Utilities and Power Marketers (Form EIA-861, *Annual Electric Power Industry Report*)**

### *Data Collected by Form EIA-861*

The Form EIA-861, *Annual Electric Power Industry Report*, and Form EIA-861S, *Annual Electric Power Industry Report (Short Form)*, collect annual data from a census of all utilities that sell electricity to end-use customers in the 50 states, the District of Columbia, Puerto Rico, American Samoa, the American Virgin Islands, Guam, and the Northern Mariana Islands. These surveys collect information on sales to ultimate customers by utilities and power marketers, energy efficiency programs, distributed generating capacity, and related data elements. The data collected include several items:

- Service territory (by state and county)
- Sales revenue to ultimate customers
- Revenue and customer count
- Source and disposition of electricity
- Advanced metering
- Demand response and energy efficiency programs
- Dynamic pricing
- Capacity and other information related to net metering
- Non-net metered distributed generating units
- Distribution system characteristics and reliability

Form EIA-861 (long form) collects data for all of these elements from approximately 2,300 utilities, while Form EIA-861S (short form) collects only some of these data from approximately 1,100 small utilities that account for about 1% of total sales. Sales data are collected on the long form by state, balancing authority, and end-use sector (residential, commercial, industrial, and mass transit transportation), but on the short form only at the state and balancing authority levels.

The sales data are collected from four groups of companies:

- Utilities that sell bundled electricity, meaning traditional utilities that sell energy and integrated delivery service
- Companies (retail power marketers) that sell but do not deliver energy in the 21 states that have retail choice
- Utilities that deliver the energy in the 21 states that have retail choice
- Retail power marketers in Texas – these companies report their energy sales, customers, and revenue, as well as the revenue for the delivery of that electricity

Respondents include the following ownership types: public and investor-owned utilities, electric cooperatives, retail power marketers, and third-party operators of solar energy systems, among others. Each month, the Form EIA-861M, *Monthly Electric Power Industry Report*, collects a sample of the annual data. No utility reporting on the short form is in the monthly sample.

You can find additional information on the data collected and types of firms included in the forms and instructions for the Form EIA-861, Form EIA-861M, and Form EIA-861S surveys on our website at

- <https://www.eia.gov/survey/#eia-861>
- <https://www.eia.gov/survey/#eia-861m>
- <https://www.eia.gov/survey/#eia-861s>

Because EIA does not collect complete information from every utility every month, EIA uses statistical imputation to estimate the activity of the electric industry each month. EIA's use of imputation is described in the section **Use of Imputation (Estimation)** at the end of this guide.

### **Where to Find Form EIA-861 Data**

**Detailed Data Files:** You can find all of the annual information we collect on the Form EIA-861 and Form EIA-861S surveys in the Excel files on our website at <https://www.eia.gov/electricity/data/eia861/>. The monthly data files, located on our website at <https://www.eia.gov/electricity/data/eia861m/>, do not include the data for retail power marketers, which are held confidential until the annual data are published.

Annual and monthly data files are available from 1990 to the most current year. However, users should be aware that the data items collected changed over time. For specific information consult the notes on the webpage for each data set (see above) and the explanatory materials inside the zip files that contain the data files.

For the 2013 data collection year, EIA implemented major revisions to sections of the annual survey that collect data on energy efficiency programs. The revisions were intended to resolve ambiguities in terminology and limit the collection to elements for which reliable data were available. The energy efficiency data are most reliable from 2013 forward.

**Aggregated Data Files:** Aggregated data from Form EIA-861, Form EIA-861M, and Form EIA-860M are published in several locations on our website:

- The *Electric Monthly Update* (<https://www.eia.gov/electricity/monthly/update/>)
- The *Electric Power Monthly* (<https://www.eia.gov/electricity/monthly/>)
- The *Electric Power Annual* (<https://www.eia.gov/electricity/annual/>)
- The annual *Electric Sales, Revenue, and Average Price* publication ([https://www.eia.gov/electricity/sales\\_revenue\\_price/](https://www.eia.gov/electricity/sales_revenue_price/))
- State-level aggregations of average price, number of retail customers, retail sales of electricity, and revenue from retail sales of electricity (<https://www.eia.gov/electricity/data/state/>)
- Time series of revenue, sales, number of retail customers, and average price beginning in 1990 reported by year, month, and state ([https://www.eia.gov/electricity/data/eia861m/xls/sales\\_revenue.xlsx](https://www.eia.gov/electricity/data/eia861m/xls/sales_revenue.xlsx))

## **Estimation of Electricity Generation from Small-Scale Solar PV Installations**

### ***Data Estimated for Small-Scale Solar PV Installations***

Small-scale solar photovoltaic (PV) installations are installations with a capacity of less than one megawatt (MW). Residential rooftop solar is the most common example. Because thousands of these small installations exist, a comprehensive data collection is impractical.

As part of the Form EIA-861 survey (described earlier), EIA collects data from utilities on the total amount of solar capacity within their service territories. EIA also collects these data from third-party owners (TPOs) on the Form EIA-861. This capacity information is the basis for estimating monthly electricity generation from small-scale solar PV installations by customer category and state.

The estimation methodology is complex. You can find a detailed description on our website in Appendix C, Technical Notes, of the *Electric Power Monthly* at <https://www.eia.gov/electricity/monthly/pdf/technotes.pdf>.

### ***Where to Find the Small-Scale Solar PV Installation Data Estimates***

Beginning in 2014 preliminary estimates of small-scale solar PV monthly capacity and electricity generation are published on our website in the *Electric Power Monthly* at <https://www.eia.gov/electricity/monthly/>; final estimates are published on our website in the *Electric Power Annual* at <https://www.eia.gov/electricity/annual/>.

## **Electricity Imports and Exports with Canada and Mexico (Form EIA-111, Quarterly Electricity Imports and Exports Report)**

### ***Data Collected by Form EIA-111***

Form EIA-111, *Quarterly Electricity Imports and Exports Report*, collects monthly statistics on transfers of electricity across U.S. borders. You can find the survey form and instructions for Form EIA-111 on our website at <https://www.eia.gov/survey/#eia-111>.

Data collection started in August 2014, covering the second quarter of calendar year 2014 (i.e., monthly data for April, May, and June 2014).

In addition to collecting data necessary for a complete picture of U.S. electricity imports and exports, the Form EIA-111 survey has a regulatory purpose. Entities holding Presidential permits for the construction and operation of cross-border transmission facilities or export authorizations meet the reporting requirements of their orders by filing the Form EIA-111 survey. The U.S. Department of Energy's (DOE) Office of Electricity Delivery and Energy Reliability (OE) manages the Presidential permit and export authorization program. You can read more about DOE's International Electricity Regulation program on DOE's website at

<https://www.energy.gov/oe/services/electricity-policy-coordination-and-implementation/international-electricity-regulation>

The types of entities that file import/export data include utilities, power marketers, and balancing authorities. EIA collects data on several different measures of cross-border power transfers. The most important are

- **Metered Flow** over U.S. international borders on facilities authorized by Presidential permits. Metered Flow is the flow of power on each transmission facility that crosses the U.S. border as measured by electric meters.
- **Actual Interchange** is the actual aggregate metered flow of power between a U.S. border balancing authority and a directly connected foreign border balancing authority.

Actual interchange is a subset of metered flow. EIA currently uses these two data sets to estimate power flows with Canada and Mexico.

The survey currently collects two additional data sets:

- **Exports and Imports arranged by commercial entities that trade in electric energy:** These commercial entities report the megawatt-hour volume of transactions and the payments or revenue involved. The quality of these data has not yet been assessed. This information will not be publicly released until this review is complete.
- **Implemented Interchange** is a value related to arrange the transfer of electric energy called for in the import or export transaction. This commercial reported value is the portion of a planned transmission transaction (*scheduled interchange*) that was actually executed. Scheduled and implemented interchange can differ, for example, when unexpected transmission constraints lead to the curtailment of a transaction.

### **Where to Find Form EIA-111 Data**

As of March 2018, the publication-quality import/export data are available from January 2016 forward. The data are presented in the following publications on EIA's website:

- *Electric Power Monthly* (<https://www.eia.gov/electricity/monthly/>)
- *Electric Power Annual* (<https://www.eia.gov/electricity/annual/>)
- *State Electricity Profiles* (<https://www.eia.gov/electricity/state/>) starting in 2018

These data are not confidential, but currently the detailed data files are not published on the EIA website.

Data on electricity trade between the United States, Canada, and Mexico also appear on the *North American Cooperation on Energy Information* website at <http://www.nacei.org/>. This website, a cooperative venture by government agencies in the three countries, also includes information on oil and natural gas trade.

## **Reliability Information about the Electricity Supply (Form EIA-411, *Coordinated Bulk Power Supply Program Report*)**

### **Data Collected by Form EIA-411**

The Form EIA-411, *Coordinated Bulk Power Supply Program Report*, collects information related to electric system loads, reserves, characteristics, and reliability. The survey form and instructions for Form EIA-411 are available on our website at <https://www.eia.gov/survey/#eia-411>.

Form EIA-411 is unique because the data are collected by the North American Electric Reliability Corporation (NERC). The survey form is completed annually by each NERC Regional Entity, which compiles data from responses furnished by utilities and other market participants within each region. NERC provides the data to EIA for each NERC assessment area (map: <http://bit.ly/2tzfRxN>). Historical data are available beginning in 1990, 1996, or 2001, depending on the data set.

NERC is the Electricity Reliability Organization designated by FERC for the Lower 48 states. You can find more information about NERC at <http://www.nerc.com/Pages/default.aspx>.

The reported regional data include several elements:

- Net energy for load (electric system demand)

- Noncoincident peak load, winter and summer peaks
- Peak-hour system demand by month and assessment area
- For both summer and winter seasons, historical and 10-year projections of net internal demand, capacity resources, and capacity margin
- Proposed high-voltage transmission line additions by year
- Generating unit and transmission outage statistics
- Smart grid transmission system devices and applications
- Transmission system maps and power flow cases by region. The availability of this information to the public is limited because it is designated as critical energy infrastructure information (CEII) (<https://www.ferc.gov/legal/ceii-foia/ceii.asp>)

Users should be aware that assessment-area footprints have changed regularly since 1990, and data series may not be consistent over time. Some areas (e.g., ECAR, MAAC, and MAIN) have dissolved, so their data series have ended. Others (PJM, MISO) have absorbed entities and grown larger over time. Because of these regional changes, data are also provided for the Eastern, Western, and ERCOT interconnections (within the United States only; portions of Canada and Mexico are removed from NERC-supplied data) as well as at a contiguous U.S. level.

### ***Where to Find Form EIA-411 Data***

**Detailed Data Files:** Detailed data are available on our website at <https://www.eia.gov/electricity/data/eia411/>.

**Aggregated Data Files:** Selected aggregated data are reported on our website in the *Electric Power Annual* at <https://www.eia.gov/electricity/annual/>.

**NERC Publications:** NERC publishes related data on its web site, starting with 2012 data published in 2013. The Electricity Supply & Demand (ES&D) database is published annually on NERC's website at <http://www.nerc.com/pa/RAPA/ESD/Pages/default.aspx>. Older versions of the ES&D are available on NERC's website at <http://www.nerc.com/pa/RAPA/ESD/Documents/Forms/AllItems.aspx>.

## **Hourly Electricity Demand, Net Generation, and Interchange (Form EIA-930, Hourly and Daily Balancing Authority Operations Report)**

### ***Data Collected by Form EIA-930***

The Form EIA-930, *Hourly and Daily Balancing Authority Operations Report*, collects hourly operating data from each electric balancing authority in the United States. The survey collects electricity demand, demand forecast, net generation, and the power flowing between each pair of directly interconnected balancing authorities. The Form EIA-930 survey is the first hourly data collection conducted by a federal statistical agency. The instructions for Form EIA-930 are available on our website at <https://www.eia.gov/survey/#eia-930>.

### ***Where to Find Form EIA-930 Data***

EIA's *U.S. Electric System Operating Data Tool* ([https://www.eia.gov/realtime\\_grid/](https://www.eia.gov/realtime_grid/)) provides near real-time demand data, plus analysis and visualizations of hourly, daily, and weekly electricity supply and demand on a national and regional level for all of the electric system balancing authorities that make up

the U.S. electric grid. Although Regional Transmission Organizations (RTOs) and Independent System Operators (ISOs), which serve about 60% of the United States have published nearly real-time information on grid operations since the late 1990s, EIA's innovative data tool expands the availability of data to the entire contiguous 48 states. The tool provides updated demand data every hour in a consistent format in one place.

Among other applications, the data can be used to provide timely information on electric system recovery after power interruptions and to help evaluate the effects of renewable energy, smart grid, and demand response programs on power system operations. The data can also facilitate more informed analysis and policy decisions on a national and regional level.

Using the tool, users can visualize and analyze several elements:

- Hourly U.S. electricity demand by region
- The hourly flow of electricity between electric systems
- Daily demand-curve shapes and the seasonality of demand patterns in different electric systems.
- The extent to which electric systems rely on internal and external sources of supply to meet the demand for electricity
- Potential stress on electric systems when actual demand significantly exceeds forecasted demand
- The hourly flows of electricity with Canada and Mexico

Several introductory videos are available through EIA's YouTube channel at <http://bit.ly/2FyYEqe>.

As of March 2018, EIA is developing an enhanced version of the *U.S. Electric System Operating Data* tool that will collect and display information on electricity generation by energy source (e.g., coal, natural gas, nuclear, solar, etc.) and sub-regional demand for large balancing authorities. The enhanced version is scheduled to be available in mid-2018.

## Forecasts of the Future of the Electricity Industry

EIA regularly publishes forecasts of the electricity (and other energy) industry. Long-term forecasts are in the *Annual Energy Outlook* (AEO: <https://www.eia.gov/outlooks/aeo/>). The near-term outlooks are published in the *Short-Term Energy Outlook* (STEO: <https://www.eia.gov/outlooks/steo/>). The STEO website includes a data browser that allows users to display the historical and forecasted values for selected data elements (<https://www.eia.gov/outlooks/steo/data/browser/>).



### III. EIA Electricity Data Resources

EIA provides many resources to facilitate access to and understanding of the data we collect and report. These resources include:

- Detailed data files in Excel format
- Web applications that allow the public to interact with and visualize EIA's electricity data
- Wholesale daily electricity price index data for selected price hubs
- *Today In Energy*, daily articles and graphs on the EIA homepage
- Social media platforms ,including YouTube, Facebook, and Twitter

#### Detailed Data Files

EIA publishes the detailed data submitted by individual respondents in Excel files that can be downloaded from EIA's website. These detailed data sets are discussed in the first section of this guide, **Description of Electricity Data that EIA Collects, Estimates, and Forecasts**, under various subsections. They are available on our website at <https://www.eia.gov/electricity/data/detail-data.html>.

The major detailed electricity data sets are:

- EIA-860 Annual Detailed Data Files: <https://www.eia.gov/electricity/data/eia860/>
- EIA-860 Monthly Detailed Data Files: <https://www.eia.gov/electricity/data/eia860m/>
- EIA-923 Detailed Data Files (Monthly and Annual): <https://www.eia.gov/electricity/data/eia923/>
- EIA-861 Annual Detailed Data Files: <https://www.eia.gov/electricity/data/eia861/>
- EIA-861 Monthly Detailed Data Files: <https://www.eia.gov/electricity/data/eia861m/>

#### Web Applications

Several EIA web applications allow users to interact with and visualize EIA's electricity data:

- EIA's *Electricity Data Browser* (EDB)
- EIA's Application Programming Interface (API) and associated spreadsheet add-ins
- EIA's *U.S. Energy Mapping System*
- EIA's *U.S. Electric System Operating Data Tool* (which provides near real-time demand data and other hourly data)

You can access these tools, apps, and maps on our website at <https://www.eia.gov/tools/>

#### Electricity Data Browser (EDB)

The *Electricity Data Browser* (EDB) (<https://www.eia.gov/electricity/data/browser/>) includes all the data sets collected and published in EIA's *Electric Power Monthly*, generally from 2002 forward, and allows users to perform dynamic charting of data sets and to map the data by state. The EDB allows users to drill down to plant-level statistics from a series of reports in the *Electric Power Monthly*. All images and data sets can be downloaded. Links to analytic reports such as the *Electricity Monthly Update*, forecasts such as the *Short-Term Energy Outlook* and *Annual Energy Outlook*, and pertinent *Today in Energy* articles are also available from the EDB.



As of March 2018 EIA has released as a public beta an enhanced version of the EDB that you can explore on our website at <https://www.eia.gov/beta/electricity/data/browser/>. This version includes power plant cooling-water data and EIA's estimates of air emissions by power plant.

A video introduction for the EDB is available on our website at <https://www.youtube.com/watch?v=gQ70w2KDbPI>

### ***Application Programming Interface (API)***

Users can link to many data series in EIA's Application Programming Interface (API). The API makes EIA's data available in a machine-readable format. The data in the API are also available in bulk files, in Excel and Google Sheets via add-ins, and via widgets that embed interactive data visualizations of EIA data on any website. Currently, EIA's API contains the following electric power and related data sets:

- Hourly electricity operating data, including actual and forecast demand, net generation, and the power flowing between electric systems
- 408,000 electricity series organized into 29,000 categories
- 30,000 *State Energy Data System* series organized into 600 categories
- 3,872 *Short-Term Energy Outlook* series and associated categories
- 368,466 *Annual Energy Outlook* series and associated categories

Other series include petroleum, crude oil imports, natural gas, coal, and international data. The EIA API is offered as a free public service, although registration is required. For more information, go to the API home page at <https://www.eia.gov/opendata/>

### **U.S. Energy Mapping System**

The *U.S. Energy Mapping System* website provides a way to visualize electricity infrastructure (and other energy infrastructure). You can find the *U.S. Energy Mapping System* with the page pre-set to display electric power-related facilities at <https://www.eia.gov/state/maps.php?v=electricity>. The list of available layers is available at [https://www.eia.gov/maps/layer\\_info-m.php](https://www.eia.gov/maps/layer_info-m.php).

A non-interactive map showing an inventory of all operable generating units in the United States is available at <https://www.eia.gov/electricity/data/eia860m/>

### **U.S. Electric System Operating Data Tool**

EIA's *U.S. Electric System Operating Data Tool* ([https://www.eia.gov/realtime\\_grid/](https://www.eia.gov/realtime_grid/)) provides near real-time demand data, plus analysis and visualizations of hourly, daily, and weekly electricity supply and demand on a national and regional level for all the electric system balancing authorities that comprise the U.S. electric grid.

### **Wholesale Electricity Price Index Data**

The EIA website provides information about wholesale electricity price index data in two locations:

Daily price data are available on the Wholesale Electricity and Natural Gas Market Data webpage (<https://www.eia.gov/electricity/wholesale/>).

The Electricity Monthly Update also includes a monthly summary of wholesale electricity prices ([https://www.eia.gov/electricity/monthly/update/wholesale\\_markets.php](https://www.eia.gov/electricity/monthly/update/wholesale_markets.php)).

### **Today In Energy Articles**

EIA has published a short article including a graph on its homepage daily since 2011. All *Today In Energy* articles on electricity are listed at <https://www.eia.gov/todayinenergy/index.php?tg=electricity>.

### **Social Media**

EIA posts videos on YouTube at <https://www.youtube.com/user/EIAgov>. The videos and webinars cover several topics:

- Electricity data
- Other energy data
- EIA's data tools
- EIA's annual energy conferences

EIA's Facebook page is at <https://www.facebook.com/eiagov/>.

EIA's Twitter account is at <https://twitter.com/EIAgov?lang=en>.

## **IV. Imputation (Estimation) Used by Electricity Surveys**

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### **Uses of Imputation**

EIA uses imputation in the context of its electricity surveys for two main reasons: (1) to reduce the reporting burden of survey respondents and the processing burden on us, and (2) to address missing data and data that appear to be submitted in error.

#### ***Reduced Burden***

Power plant operations data are collected monthly from a sample of respondents. Similarly, retail sales data are collected monthly from a sample of respondents. EIA uses statistical techniques to estimate values for the non-sampled respondents in both data collections. Because the annual collection is a census, the imputed values in the monthly publication are replaced by reported values in the annual publication.

#### ***Missing Data and Data Submitted in Error***

The same statistical techniques are also used to estimate values for respondents who have failed to provide data (*non-respondents*) and for respondents who appear to have submitted erroneous data that cannot be corrected before publication deadlines.

### **Documentation of Imputation**

Appendix C, Technical Notes, of the *Electric Power Monthly* (<https://www.eia.gov/electricity/monthly/pdf/technotes.pdf>) describes the sampling and estimation methodology we use in the context of the electricity surveys.