



# BPI-2200-S-2013

STANDARD FOR HOME PERFORMANCE-RELATED DATA COLLECTION  
v2.3.0



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# Table of Contents

<a href="#">Introduction (Informative)</a> .....	1
<a href="#">1. Scope</a> .....	1
<a href="#">2. Objective</a> .....	1
<a href="#">3. Alignment with Other Standards</a> .....	2
<a href="#">4. Data Vocabulary</a> .....	2
<a href="#">5. Required Use of Vocabulary</a> .....	3
<a href="#">6. Data Sets for Specific Use Cases</a> .....	3
<a href="#">Annex A: Guidance Regarding Use of Data Elements (Informative)</a> .....	4
<a href="#">A.1. Relationships Between Data Elements</a> .....	4
<a href="#">A.2. Multiple Ways to Describe Building Characteristics</a> .....	4
<a href="#">A.3. Organization of Data Elements</a> .....	5
<a href="#">A.4. Data Element Description</a> .....	5
<a href="#">A.4.1 Customer Information</a> .....	5
<a href="#">A.4.2 Contractor Information</a> .....	6
<a href="#">A.4.3 Site and Building Envelope</a> .....	6
<a href="#">A.4.4 Systems</a> .....	8
<a href="#">A.4.5 Appliances</a> .....	10
<a href="#">A.4.6 Lighting and Miscellaneous Loads</a> .....	10
<a href="#">A.4.7 Swimming Pools</a> .....	10
<a href="#">A.4.8 Health and Safety</a> .....	10
<a href="#">A.4.9 Project Information</a> .....	11
<a href="#">A.4.10 Consumption</a> .....	12
<a href="#">A.4.11 Utility or Fuel Provider</a> .....	12
<a href="#">A.4.12 Software</a> .....	13
<a href="#">Annex B: BPI-2200-S-2013 v.2.3.0 HPXML Data Elements (Normative)</a> .....	14

## Introduction (Informative)

BPI-2200-S-2013 v2.3.0 *Standard for Home Performance-Related Data Collection* (BPI-2200) is designed to facilitate communication and the exchange of information and data among all actors in the home performance industry by providing a standard vocabulary for describing terms related to buildings, energy consumption, and energy conservation measures (ECMs).

The term “home performance” is used in this standard in a broad sense of the term to indicate the practices used to increase the energy efficiency (i.e., reduce the energy consumption) of residential buildings considered as a system.

The terms “whole-house upgrade” or “upgrade” are used in this standard to indicate a comprehensive set of measures that together significantly increase the energy efficiency of a building. The synonymous term “retrofit,” although common in the home performance industry, is not used in this standard.

The terms “energy audit” and “audit” are used interchangeably to indicate an assessment of the opportunities for reducing the energy consumption of a building.

## 1. Scope

This standard provides requirements for the prescribed fields for collecting home performance-related data and the minimum measure description collection criteria. The scope of this standard is limited to existing detached single-family dwellings and townhouses that have independent mechanical systems for each dwelling unit (heating, cooling, water heating, and ventilation); direct access to outdoors for each dwelling unit; and were designed to have continuous party walls with no penetrations to adjacent units, with such party walls extending from ground to roof where the dwelling unit is attached to one or more adjacent single-family dwelling units.

## 2. Objective

The standard is intended to reduce the transactional costs associated with collecting and transferring data by making communication between systems easier, and by providing a basis for the creation of data transfer and storage standards. BPI-2200 is also intended to enhance research and evaluation efforts by facilitating comparison and analysis of information from multiple programs through data standardization.

BPI-2200 does not specify all terms used within the home performance industry. Many of the detailed terms needed for energy modeling or for quality assurance (QA), for example, are not included in this iteration of the standard. Future versions of BPI-2200 may be expanded to include such terms.

### 3. Alignment with Other Standards

BPI-2200 is intended to provide the data elements that form the basis of the extensible mark-up language (XML) schema defined in a separate BPI standard (BPI-2100-S-2013 *Standard for Home Performance-Related Data Transfer v2.3.0*). BPI-2100 provides a way to structure and communicate information about whole-house energy efficiency upgrades.

To promote standardization within the residential energy efficiency industry, BPI-2200 is also aligned with the data needs and vocabularies of two initiatives supported by the U.S. Department of Energy: the Building Energy Data Exchange Specification (BEDES) and the Home Energy Score (HES).

The goal of BEDES is to facilitate the utilization and sharing of empirical building energy performance data among software tools and data collection and analysis activities, more easily and consistently and at lower cost. It provides the data elements used in the Standard Energy Efficiency Data (SEED) platform, a software application that helps organizations easily manage data on the energy performance of large groups of buildings. Because BEDES is focused on commercial as well as residential buildings, BEDES contains data elements not relevant to the scope of BPI-2200; conversely, BPI-2200 contains elements specific to the home performance industry that are not included in BEDES. For the subset of information relevant to both data sets, an effort was made to use the same definitions and to structure the data in the same way to ensure the greatest degree of compatibility.

BPI-2200 is also designed to include all terms necessary to generate a HES.

### 4. Data Vocabulary

BPI-2200 defines a standard vocabulary of data elements necessary to provide a general description of a whole house energy efficiency upgrade for reporting, rebate and basic QA purposes. This vocabulary allows description of the following:

- Contractors
- Customers
- Buildings, building components and building systems
- Energy conservation measures
- Energy consumption
- Energy savings (estimated and actual)

The vocabulary allows description of both the physical properties and performance of buildings and measures.

## **5. Required Use of Vocabulary**

Compliance with BPI-2200 requires use of these data elements in all cases in which a BPI-2200 data element is sufficient to adequately represent the person, characteristic, concept or other home-related datum. Data can be “adequately represented” by the BPI-2200 vocabulary if BPI-2200 data elements, singly or in combination, can provide a representation of the thing or person to be described that a) could reasonably be understood by other home performance professionals, and b) does not result in significant loss of information or create significant risks of miscommunication.

## **6. Data Sets for Specific Use Cases**

BPI-2200 is intended to define 1) a vocabulary for the home performance industry and 2) the data sets required to be collected for specific use cases, such as the energy audit or the job completion report.

This version of BPI-2200 addresses only the first objective: defining a common vocabulary for the home performance industry. Future versions of the standard will specify required or recommended data sets for specific uses.

## **Annex A: Guidance Regarding Use of Data Elements (Informative)**

This informational annex provides additional information regarding the organization and structure of the data elements that are not evident from the list format in which they are presented in Annex B.

In this section, data elements specified in BPI-2200 are indicated in quotation marks (e.g., “auditor qualification”). Explanations are made in terms of how the data elements specified in the standard can be used. Often there are several data elements that can be used to describe a particular characteristic of a building or measure of a home performance upgrade. “Glass type,” for example, can be used to describe the nature of the glass used in a window through use of a standard set of other data elements, including “low-e,” “tinted,” or “reflective.” The characteristics of a window can also be described with the elements “U-factor,” “NRFC-certified,” or “frame type.” This writing convention is carried throughout the standard.

### **A.1. Relationships Between Data Elements**

Some relationships between data elements are explicitly specified. Many data elements can be described by a set of other data elements. A window frame, for example, can be described as “aluminum,” “composite,” “fiberglass,” “steel,” “vinyl” or “other.”

Other relationships are implicit. Data elements describing the nature or monetary value of specific incentives, for example, could be associated with a wide range of energy conservation measures, such as insulation or duct sealing, or with an entire whole-house upgrade.

### **A.2. Multiple Ways to Describe Building Characteristics**

In a number of cases, BPI-2200 provides more than one way to describe a specific building component or energy conservation measure. A building’s air leakage, for example, can be described either in terms of a blower door measurement (e.g., numberCFM50), or through use of a set of specified qualitative terms (“very tight,” “tight,” “average,” “leaky,” etc.).

These different pathways for describing the same characteristic reflect the fact that different users require different degrees of accuracy. If a program does not require blower door testing, for example, participating contractors will not typically be able to provide an infiltration measurement in CFM50; the standard provides an alternative way to describe building leakiness in such situations.

It is expected that users will structure the data elements defined in BPI-2200 in multiple ways, according to their specific needs.

### **A.3. Organization of Data Elements**

The data elements listed in Annex B comprise the BPI-2200 standard vocabulary. For the sake of presentation, the data elements in Annex A are organized into a set of general categories:

- Customer Information
- Contractor Information
- Site and Building Envelope
- Systems
- Appliances
- Lighting
- Pools
- Health and Safety
- Project Information
- Utility or Fuel Provider
- Consumption
- Software

### **A.4. Data Element Description**

Much of the vocabulary in BPI-2200 is self-evident in that the name of the data element is similar or identical to a word typically used in the home performance profession. The “door” data element, for example, corresponds to what is typically referred to as a “door” in the home performance industry, i.e., a movable barrier located in an entranceway between two spaces separated by a partition.

Definitions for some of the less self-evident or self-explanatory data elements are provided in this section and in Annex B.

#### **A.4.1 Customer Information**

The data elements in the Customer section can be used to provide contact information about the customer (name, mailing address, phone number, e-mail address, etc.) or other contacts.



## **A.4.2 Contractor Information**

The data elements in the Contractor section can be used to provide information about contractors, subcontractors, and their businesses. This includes individual contact information, which is replicated in the customer section above, business information (business name, address, telephone number, etc.) and qualifications or certifications held by the business.

Contractors can also be identified by business type (auditor, contractor, subcontractor, property manager) and by specialization (HVAC, insulation, etc.).

## **A.4.3 Site and Building Envelope**

The data elements in the Site and Building Envelope section enable a description of the building being upgraded, including a description of the occupants, the site, and construction details.

Data elements concerning a “site,” including address and school district, can be used to indicate the project location, but can also be used to describe other locations, such as a business office.

A site can be given a unique “Site ID.” This can be used to ensure that all sites that receive an upgrade through a program can be easily identified and distinguished.

Sites can be described in terms of their location in a number of zones, including the U.S. Department of Energy and International Energy Conservation Code climate zones, termite zones, radon zones, and others.

### **A.4.3.1 Zone**

The “zones” and “spaces” data elements allow specific areas within a building to be identified, and for HVAC, lighting, and other systems to be associated with a specific zone or space.

Many use cases will not require the level of detail that the data elements in this section allow. However, if a detailed description of the shape of a building, or of a building’s wall assemblies, is necessary, the data elements in this section would allow a description of these elements in considerable detail.

### **A.4.3.2 Enclosure**

This section incorporates data elements that make up a building’s enclosure or building envelope.

#### ***Air sealing***

“Test ID” can be used to provide a unique test identification number if multiple tests need to be recorded.

Building leakiness can be described in two ways: either with a number indicating air leakage in terms of a specific unit (e.g., CFM50, ACHnatural), or in qualitative terms (“very tight,” “tight,” “average,” etc.)

### ***Insulation***

Insulation can be described in multiple ways. It can be described either in terms of nominal R-value or in terms of inches. It can also be described by type (e.g., fiberglass, cellulose).

The “layer” data element allows for individual layers of insulation to be described for situations in which two or more types of insulation have been installed or applied in the same area.

Data elements to indicate the location where a particular type of insulation was installed, including “attic roof,” “attic kneewall,” “crawl space wall,” etc., are provided.

### ***Attic and Roof***

Attic and roofs can be described in terms of type, surface area, color, pitch, and slope. This subsection also includes information on rafters, including framing factor and studs.

### ***Foundations***

This section includes information on foundations including location, thermal boundary, frame floor, slab, and foundation walls. Each area or type of foundation (i.e., frame floor, slab, foundation walls) has a system ID associated with it so the data element can be referenced with other elements, for example, when there is a window on a foundation wall.

### ***Rim Joists***

Rim joists may be described in terms of surface area, proximity to other areas of the building, and stud size, material, and spacing.

### ***Walls***

Walls can be described in terms of their proximity to other rooms of a house, orientation, size, color and material.

### ***Windows***

The Window ID data element allows windows to be grouped according to type, i.e., windows with similar characteristics (similar glazing, frames, location, etc.) can be grouped together. In cases in which only very general information about all windows in a building is required, or in which all windows in a building are identical, a single Group ID can be used.

A window or window group can be described in terms of a number of characteristics, including orientation, condition, glass type, number of layers, U-factor, NFRC-certified, interior and exterior shading, etc.

The “window area” data element can be used to provide the square footage of all windows in a window group.

Subjective evaluation of window condition can be made in terms of “good,” “moderate,” or “poor.”

Window groups can be identified according to the wall in which they are located

The window-to-wall ratio of the building can be provided.

### ***Doors***

The “Door ID” data element allows doors to be organized into groups with common characteristics.

### ***Skylights***

The characteristics of glass in skylights can be described using the same data elements that allow description of windows.

## **A.4.4 Systems**

The vocabulary allows HVAC systems to be identified with a system ID, which facilitates descriptions of buildings with multiple systems. This also allows for a system or systems to be:

- Associated with a building location (e.g., a CAZ or a Zone);
- Associated to one or several distribution systems;
- Associated with a control device (e.g., a device that controls both an AC and a furnace)

Data elements that can be used to describe any HVAC system are grouped together.

Data elements for describing specific types of HVAC systems are subdivided into three sections: heating, cooling, and heating and cooling. The heating and cooling section includes data elements designed specifically to describe heat pumps.

In buildings with multiple zones, HVAC systems can be identified as providing heating or cooling to a specific zone.

Data elements are provided to identify which combustion venting system and distribution system are used by an HVAC system. (Both combustion venting and distribution systems can be given a System ID.)

A standard list of fuel types is provided for all HVAC systems.

Vocabulary provided for HVAC controls includes information about control type, setpoint/setup/setback temperatures, and other information.

Several data elements allowing a general description of maintenance schedules and several common types of maintenance are provided.

#### A.4.4.1 Combustion Ventilation

HVAC combustion venting systems can be given a System ID, which allows the description of a situation in which HVAC or hot water systems are using a shared venting system.

#### A.4.4.2 HVAC Distribution Systems

The data elements in this section allow description of HVAC distribution systems. Each system can be identified with an ID, in the event that there are more than one in the building. As mentioned above, the HVAC Distribution ID can also be used to associate a single distribution system with one or more HVAC units. For example, a duct system can be associated with both an AC and a furnace. Duct improvements could then be associated with the performance characteristics of the AC and the furnace system. The zones that each system serves can also be identified.

The data elements in this section allow description of duct leakage. As with building leakage, two options for describing duct leakage are provided: a quantitative reading in CFM25 (or other units), or a qualitative description that includes the data elements “no observable leaks,” “some observable leaks,” “catastrophic leaks,” etc.

#### A.4.4.3 Domestic Hot Water (DHW) Systems

DHW systems can be identified with a system ID if the home has several such systems.

The list of DHW types includes types that would commonly be encountered in a home performance upgrade.

As with HVAC systems, a DHW system can be identified as being in a particular zone, if necessary.

The data elements in this section allow description of DHW distribution systems and insulation, including pipe insulation and water heater jackets.

#### A.4.4.4 Photovoltaic

The data elements in this section allow for a basic description of a photovoltaic array, including “array azimuth,” “array tilt,” and “maximum power output,” the location of the PV system, inverter efficiency, ownership, and the year the inverter was manufactured.

#### A.4.4.5 Wind

The data elements in this section allow for a basic description of a wind turbine including model, year installed, hub height, and rotor diameter. Data elements also allow for a description of the AWEA rated sound level, annual energy, and rated power.

#### **A.4.5 Appliances**

A number of data elements potentially relevant for describing all types of appliances are grouped together. These include manufacturer, model number and year, serial number, and third-party certification.

Vocabulary or data elements specific for describing different types of appliances are shown under the heading of the appropriate appliance.

Several data elements address behavioral phenomena, such as “Usage” in loads per week for dishwashers.

#### **A.4.6 Lighting and Miscellaneous Loads**

The “Lighting ID” data element allows lights with common characteristics, such as type and average wattage, to be grouped together. Other common characteristics of the lighting group can be described, including average wattage, third party certification, and floor area served.

Two different ways to describe lighting usage are provided: either average hours per day per bulb can be indicated, or usage can be indicated by a series of ranges (1-4 hours per day, 4-12 hours per day, etc.).

The “attached to space” data element allows a light or lighting group to be identified as located within a specific space in the building (as described with the “space” data element).

Data elements for describing lighting controls are provided.

Data elements for a set of major plug loads (e.g., plasma TV, computer, space heater, water bed, electric vehicle, etc.) are provided. The “other” data element allows plug loads to be indicated as necessary.

#### **A.4.7 Swimming Pools**

The data elements in the Swimming Pools section can be used to describe the characteristics and use of one or more swimming pools, pool pumps, cleaners, and heaters. Data elements can be used to characterize in ground, above ground, or on ground pools, as well as pool volume, months per year of operation, and filter type.

#### **A.4.8 Health and Safety**

The data elements in the Health and Safety section concern ventilation (whole-house and spot), Combustion Appliance Zone (CAZ) testing, combustion appliance testing, lead paint, asbestos, radon, source pollutants and pests.

BPI standards were used as guidance for the vocabulary for the CAZ and appliance testing sections, and a number of U.S. Environmental Protection Agency documents were used as guidance for the vocabulary for environmental hazards.

#### A.4.8.1 Ventilation Design

An ID number can identify fans if multiple fans need to be described.

#### A.4.8.2 Combustion Appliance Zone Testing

If multiple CAZ are present, an ID number can identify them. These ID numbers can be used to indicate in which CAZ a specific combustion appliance is located.

The term “poor case” is used rather than “worst case” to indicate a number of testing conditions, as it cannot usually be proven that a given set of conditions represents a “worst case.”

#### A.4.8.3 Moisture Control

The data elements in this section allow identification of areas within the building where water damage is located and several common moisture control measures.

### **A.4.9 Project Information**

A project can be assigned a unique Project ID to distinguish it from all other projects. The Project ID can be used to distinguish between projects conducted in two different dwelling units in the same building, or two projects done at different times in the same building or dwelling unit.

The program name and sponsor can be identified, if applicable.

The “Project Status” data element can be used to indicate what phase of the upgrade process a particular set of data pertains to. Options include the audit, the proposed work scope, the approved work scope, test out/job completion and QA. “Start date,” “estimated completion date,” and “actual completion date” data elements can be used to provide additional information about the timing of a project.

“Project cost” can be used to specify the total cost of the project, and incentives can be used to detail one or more incentives associated with the project.

Energy savings data elements can be used to provide information about projected or actual (measured) energy savings associated with a project or measure. Savings can be expressed in a number of ways, including total savings, cost savings or savings by dollars, as well as savings by particular fuel. End use savings can also be provided for specific fuels.

Detail about the measures proposed or implemented as part of the upgrade can be described in detail. A number of data elements can be associated with each measure, as necessary, including:

- Quantity
- Location within the building
- Estimated life
- Installation date
- Cost
- Incentives associated with the measure
- Resources savings
- Energy savings
- Water savings
- Installing contractor (or subcontractor)
- Status (recommended, installed, not installed)
- QA status (passed, failed, not tested, comments)
- Repaired
- Replaced

#### **A.4.10 Consumption**

The data elements in this section can be used to describe water and energy savings and consumption. Water and energy consumption can be described in a number of ways, including unit of measurement, cost, reading type, and interval type.

This section also contains data elements that describe the information necessary for the “true-up” calculations specified in ANSI/BPI-2400-S-2015 *Standard Practice for Standardized Qualification of Whole-House Energy Savings Predictions by Calibration to Energy Use History*.

Data elements for detailing water consumption are also provided.

#### **A.4.11 Utility or Fuel Service Provider**

The vocabulary allows details about the utility or fuel/resource provider to be collected, including meter and account numbers, and whether permission was granted to access the data.

A unique ID number may identify utility or fuel service providers if there are multiple service providers per project or building.

#### **A.4.12 Software**

The data elements in this section include information on the type of software used for modeling and its version.



## **Annex B: BPI-2200-S-2013 v.2.3.0 HPXML Data Elements (Normative)**

The HPXML Data Dictionary is online at <https://hpxml.nrel.gov/datadictionary/2.3.0/>.