

FOR ELCAP INTERNAL USE

ENDUSES

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## 1.0 RESIDENTIAL ENDUSES

### 01 TOT BUILDING TOTAL

The total electrical usage for a single site. For most sites, the total is the sum of the building mains. For other sites the total is calculated from the sum of all the individual feeders. All data are stored as average watts.

### 02 HOT HOT WATER

The electrical usage of the hot water heater (or heaters) at a site. In the case of gas or oil-fired water heaters, this enduse will include the electrical usage of any electrical control equipment associated with the hot water heater. No proxy enduses for fossil fuel usage are measured. All data are stored as average watts.

### 03 HVA HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

The electrical usage of all heating, ventilation, and air conditioning equipment at a site. This includes essentially all space conditioning equipment except air-to-air heat exchangers and humidifiers. Heat pumps are included in this enduse due to their ability to both heat and cool. In the case of fossil fuel residences, this enduse will include only the electrical portions of the HVAC system. No proxy enduses for fossil fuel usage are measured. All data are stored in average watts.

In those sites with separable heating and cooling circuitry, the following enduses (04 and 05 ) will be available. If the heating and cooling circuit share any devices in common, these enduses will not be available.

### 04 HTR SPACE HEATING

The electrical usage of all space heating equipment at a site. Only independent heating systems are included here. A heating system that shares an air handling unit with an air conditioner would not show up here. The heat from a baseboard heated house would show up here. All data are stored in average watts.

### 05 AIR AIR CONDITIONING

The electrical usage of all air conditioning equipment at a site. Once again, only independent air conditioning systems are included here. All data are stored in average watts.

#### 06 MHT MIXED HEAT

The electrical usage of any space heating equipment that is mixed in with other enduses. This enduse was designed primarily for houses that have baseboard heaters that are plugged into wall sockets. The heaters are more or less permanently installed but other devices may be plugged into the same circuit. Rather than include these channels in the lights and conveniences enduse, they are put into mixed heat. The analyst can then decide how best to use the data for the particular analysis at hand. All data are stored in average watts.

#### 07 OTH OTHER/MIX

The electrical usage of all devices at the site except for those included in HVAC and HOT WATER. This enduse is split out into more specific enduses below. This enduse is provided mainly for analysts who are interested in classic triple-metering data rather than the more disaggregated enduses discussed below. All data are stored in average watts. The remaining electrical enduses (08 thru 20) are disaggregations of the OTHER/MIX enduse. Any number of these enduses may be present at any individual site.

#### 08 LIT LIGHTS/CONVENIENCES

The electrical usage of all identifiable lighting or wall plug circuits that are not used for a major appliance at a site. For example, a wall plug circuit with a refrigerator or washer on it would not be included here. A circuit that contained the living room wall plugs with a TV and stereo would be included here. Essentially, LIGHTS/CONVENIENCES is what is left over after the major appliances are split out of OTHER/MIX. All data are stored in average watts.

If the site is wired so that there are zoned lights/conveniences circuits, the following enduses (09 and 10) will be available. If there is any question about the location of any circuits, these enduses will not be available.

#### 09 KLC KITCHEN LIGHTS/CONVENIENCES

The electrical usage of all identifiable lighting or wall plug circuits associated solely with the kitchen. This is a subset of the LIGHTS/CONVENIENCES enduse that is provided for those analysts interested in studying kitchen related activities. Once again, if a circuit has a major appliance on it, that circuit will not be included here. All data are stored in average watts.

#### 10 OLC OUTSIDE LIGHTS/CONVENIENCES

The electrical usage of all identifiable lighting and outlets associated with the exterior of the site. This would include patio or deck outlets, exterior lights, and may include garage or shop circuits. All data are stored in average watts.

11 REF     PURE REFRIGERATOR

The electrical usage of any refrigerators at the site that have dedicated refrigerator circuits. If it appears that any other device is mixed with the refrigerator, the refrigerator circuit is labelled MIXED REFRIGERATOR. All data are stored in average watts.

12 MRF     MIXED REFRIGERATOR

The electrical usage of any refrigerators at the site that do not have dedicated refrigerator circuits. The refrigerator usage is mixed with lights, other appliances, or wall outlets in sites with this enduse. All data are stored in average watts.

13 FRZ     FREEZER

The electrical usage of any freezers at the site that have dedicated circuits. Freezers that are merely plugged into basement or garage wall outlets are not necessarily included here. If the data showed no evidence of other devices, the circuit would be labelled freezer. All data are stored in average watts.

14 FDP     FOOD PREPARATION

The electrical usage of any food preparation devices at the site that have dedicated circuits. This includes ranges, stoves, grills, and cook tops. Microwave ovens are included only if they have a dedicated circuit. No proxy enduses are included for the use of fossil fuel devices. All data are stored in average watts.

15 DWA     DISHWASHER

The electrical usage of the dishwasher at the site if the dishwasher exists and is on a dedicated circuit. All data are stored in average watts.

16 CWA     CLOTHES WASHER

The electrical usage of the clothes washer at the site if it exists and is on a dedicated circuit. Many times the clothes washer is on wall outlet circuit and is therefore not broken out as an enduse. All data are stored in average watts.

17 DRY     CLOTHES DRYER

The electrical usage of the clothes dryer at the site if it exists and is on a dedicated circuit. Most dryers are on dedicated circuits and are therefore broken out as enduses. All data are stored in average watts.

18 AHE      AIR TO AIR HEAT EXCHANGER

The electrical usage of the air to air heat exchanger at the site if it exists and is on a dedicated circuit. All data are stored in average watts.

- 19 SM1      SPECIAL MAJOR APPLIANCE 1
- 20 SM2      SPECIAL MAJOR APPLIANCE 2

The electrical usage of major devices not covered in the above enduses. These enduses have contained pottery kilns, jacuzzis, hot tubs, espresso machines, garden pumps, well pumps, and shops. All data are stored in average watts.

- 21 AH1      AIR TO AIR HEAT EXCHANGER TEMPERATURE 1
- 22 AH2      AIR TO AIR HEAT EXCHANGER TEMPERATURE 2

The average temperature of the air to air heat exchanger exhaust vent over the previous data collection period. This is the temperature of the room air that is exhausted to the outside after passage through the heat exchanger. All data are stored as degrees-Kelvin times ten. A reading of 2971 therefore corresponds to 297.1K or 24 C.

- 23 ST1      WOOD STOVE THERMAL SENSOR
- 24 ST2      WOOD STOVE SWITCH OR THERMAL SENSOR
- 25 ST3      WOOD STOVE TEMPERATURE SENSOR
- 26 ST4      HOOD RIVER WOOD STOVE TEMPERATURE

All four of these enduses are involved in the monitoring of wood stove usage in the ELCAP or the Hood River Study. There are three types of sensors in use in ELCAP and one in the Hood River Study. The thermal sensor type produces a signal proportional to the temperature difference between the flue gas temperature and a reference junction outside the flue. A woodstove not in use typically produces a signal of 300 to about 1000 on this type of sensor. A reading of more than 2000 on this enduse indicates woodstove usage. A reading between 1000 and 2000 is indeterminate. The switch type sensor is designed to read full scale (5 volts) when the wood stove is on and 0 when the stove is off. The reading in the data is then a number between 0 and 5 volts that indicates the percent of time during the previous data collection period that the wood stove was on. The wood stove temperature sensor actually measures the flue gas temperature in degrees-Kelvin times ten. The Hood River wood stove sensor is similar to the ELCAP wood stove temperature sensor. The vast majority of ELCAP wood stove sensors are of the thermal sensor type.

27 VT1      REFERENCE VOLTAGE

This enduse is record of the data logger's internal reference voltage. The voltage should be between 4.96 and 5.00 volts. The data is stored as either volts (0-5) or volts times ten (0-500).

94 IT1 INTERIOR TEMPERATURE 1  
thru to  
113 IT20 INTERIOR TEMPERATURE 20

The interior temperature of the site at various locations within the site are included here. All data are stored as degrees-Kelvin times ten.

## 2.0 COMMERCIAL ENDUSES

### 28 BLT BUILDING TOTAL

Energy used by the entire building. In ELCAP, a large building may have several data loggers monitoring the building. Only one logger will contain the building total. All data stored in average watts.

### 29 LGT LOGGER TOTAL

Energy used by one data logger in building. Used mainly for verification purposes. All data stored in average watts.

### 30 SUM LOGGER SUMCHECK ONLY

Energy used by some portion of one data logger in building. Used solely for verification purposes. All data stored in average watts.

### 31 HEA HEATING

Energy used solely for the purpose of increasing the temperature of space within the building envelope. All data stored in average watts.

### 32 PHE ELECTRICAL PROXY FOR HEAT

Electrical energy used by blowers, fans, controllers, pumps, etc., in a fossil fuel heated building. The assumption is made that the amount of electricity used by the auxiliary equipment is more or less proportional to the fossil fuel usage, or is at least an indication of when the fossil fuel heaters are in use. All data stored in average watts.

### 33 COL COOLING

Energy used solely for the purpose of decreasing the temperature of space within the building envelope. All data stored in average watts.

### 34 VNT VENTILATION

Energy used solely for the purpose of moving outside air into the building envelope or exhausting air from within the building envelope. All data stored in average watts.

### 35 AUX AUXILIARIES

Energy used to support the space heating, cooling, and ventilation functions such as crankcase heaters, damper motors, and fluid distribution pumps. All data stored in average watts.

36 MIX MIXED HVAC

Energy used solely for some combination of space heating, space cooling, and/or ventilation when they cannot be completely disaggregated. All data stored in average watts.

37 ILT INTERIOR LIGHTING

Energy used solely for the illumination of the spaces within the building envelope. All data stored in average watts.

38 OLT EXTERIOR LIGHTING

Energy used solely for the illumination of the building exterior, access routes, parking, or signs. All data stored in average watts.

39 RFN REFRIGERATION

Energy used for freezers, refrigerators, water coolers, ice machines and other cold storage spaces. All data stored in average watts.

40 H2O WATER HEATING

Energy used solely for increasing the temperature of water for process (non space heating) or sanitation use. All data stored in average watts.

41 PWE ELECTRICAL PROXY FOR HOT WATER

Electrical energy used by pumps, fans, etc., as auxiliaries to a fossil fuel hot water heater. The assumption is made that fossil fuel usage may be predictable by auxiliary usage. All data stored in average watts.

42 PWT TEMPERATURE PROXY FOR HOT WATER

43 GT1 FLUE GAS TEMP FOR HOT H2O 1

44 GT2 FLUE GAS TEMP FOR HOT H2O 2

45 GT3 FLUE GAS TEMP FOR HOT H2O 3

Flue gas temperatures for fossil fuel water heaters. The assumption is made that the hotter the temperature, the more fossil fuel usage. All data stored in degrees-Kelvin times ten.

46 PLG RECEPTACLES

Energy provided to convenience outlets for unspecified application. Where the convenience outlets are clearly devoted to a particular end-use such as food preparation for receptacles in a kitchen, the energy use can be assigned to the more descriptive category. All data stored in average watts.



47 ELV        VERTICAL TRANSPORT

Energy used solely for the purpose of elevating or lowering people or materials including elevators, escalators, and dumb waiters. All data stored in average watts.

48 FOO        FOOD PREPARATION

Energy used solely for the preparation, cooking, or presentation of food. All data stored in average watts.

49 PCT        TEMPERATURE PROXY FOR COOKING

The flue gas temperature of the off gas in those sites with gas grills or fossil fuel stoves or ovens. The higher the temperature, the more fuel usage. All data stored as degrees-Kelvin times ten.

50 MTR        MATERIAL HANDLING

Energy used solely for the movement or handling of materials. This end-use includes such equipment as trash compactors, conveyors, and garbage disposals. All data stored in average watts.

51 DAT        DATA PROCESSING

Energy used solely for the processing of information. This includes items such as computers, copiers, and miscellaneous office equipment. All data stored in average watts.

52 REC        RECREATION

Energy used solely for recreational purposes such as video games, swimming pools, and sound equipment. All data stored in average watts.

53 SAN        SANITATION

Energy used solely for the purpose of cleaning or disinfecting such as dishwashers and laundry equipment. All data stored in average watts.

54 LAB        LABORATORY

Energy used for scientific or medical appliances such as centrifuges and x-ray machines. All data stored in average watts.

55 SHP        SHOP

Energy used for various appliances associated with light manufacturing such as sewing machines and table saws. All data stored in average watts.

56 GEN        GENERAL-MIXED

Energy used for any mixture of the above end-uses when it was not practicable to disaggregate them. All data stored in average watts.

57 UNK        UNKNOWN

Energy supplied to electrical circuits for purposes which can not be ascertained. All data stored in average watts.

- 58 SP1        SPECIALTY 1
- 59 SP2        SPECIALTY 2
- 60 SP3        SPECIALTY 3
- 61 SP4        SPECIALTY 4
- 62 SP5        SPECIALTY 5

Energy used for other special applications such as security systems, communication systems, and particular processes. All data stored in average watts.

- 63 LFA        HOOD RIVER A-PHASE SUBSTATION LINE FEEDER
- 64 LFB        HOOD RIVER B-PHASE SUBSTATION LINE FEEDER
- 65 LFC        HOOD RIVER C-PHASE SUBSTATION LINE FEEDER

Energy being transmitted by the monitored substation in the Hood River Study.

66 BTU        HEAT FLUX

The heat flux through the walls of a heating duct. This enduse is active for only one test logger. All data stored in BTU's.

67 GFL        GAS FLOW

The air flow through a heating duct. This enduse is active for only one test logger. All data stored in cubic feet.

- 68 WHB        WATT HOUR BOARD RECONSTRUCTION
- 69 A2D        ANALOG TO DIGITAL CONVERTER RECONSTRUCTION

These enduses are for use in the reconstruction of commercial data where a partial data logger failure occurred due to hardware or installation problems. Due to the redundant sum check procedures in ELCAP, we are often able to reconstruct missing data for any portion of a fully monitored site. The data reconstructed may consist of any number of enduses and it is not appropriate to attribute the data to any one enduse. The analyst may add any data in this enduse to whatever other enduse or enduses seem appropriate. All data are stored in average watts.

70 X01        STATUS SENSOR 01  
thru        to  
93 X24        STATUS SENSOR 24

Indicator of the on/off status of monitored device. A "0" reading indicates off, a "5" indicates on, and a value in between indicates the percentage of time during the previous data collection period that the device was on.

94 IT1        INTERIOR TEMPERATURE 1  
thru        to  
113 IT20       INTERIOR TEMPERATURE 20

The interior temperature of the site at various locations within the site are included here. All data are stored as degrees-Kelvin times ten.

### 3.0 METEOROLOGICAL ENDUSES

114 OT1      OUTDOOR TEMPERATURE 1  
115 OT2      OUTDOOR TEMPERATURE 2  
116 OT3      OUTDOOR TEMPERATURE 3  
117 OT4      OUTDOOR TEMPERATURE 4

The outside air temperature as measured by a precision thermister in an unaspirated housing. At the meteorological station sites, the sensor is located on a mast above the roofline of the building. On other buildings, it is located on the north wall of the structure, under the eaves. All temperature data are stored in units of Degrees Kelvin times ten.

118 HM1      RELATIVE HUMIDITY 1  
119 HM2      RELATIVE HUMIDITY 2

The ratio of the actual vapor pressure of the air to the saturation vapor pressure. At the ELCAP sites, the sensing element is a thin polymer film that absorbs/desorbs atmospheric water vapor, changing the dielectric constant of the capacitance of the element. Units of relative humidity are percent.

120 WSP      WIND SPEED

On the ELCAP buildings, wind speed is measured by a rotating cup anemometer located on a mast above the roofline of the building. At the NWS sites, the anemometer is on a mast 10m above the ground, in an area free from any obstruction to air movement. All wind speed data are stored in units of cm/sec.

121 WDR      WIND DIRECTION

The direction from which the wind is blowing, referenced to true north, not magnetic north. At the ELCAP sites, it is measured by a vane mounted on a mast above the roofline of the building. At the NWS sites, it is measured at 10m above the ground, in an area free from any obstruction to air movement. Wind direction is stored in compass degrees, with north=0, east=90, south=180, and west=270 degrees.

122 GHZ      GLOBAL HORIZONTAL RADIATION

The total of direct solar radiation and diffuse sky radiation received on a unit horizontal surface. Also referred to as total horizontal insolation. Total horizontal insolation is measured by pyranometers at ELCAP buildings and estimated from a model at the NWS sites. For the TMY and WYEC stations, the total horizontal insolation is measured at Seattle and Medford and estimated from a model at other sites. All data are stored in units of watts/m-sq.

123 ETR      EXTRA-TERRESTRIAL RADIATION

Solar radiation received 'on top of' the earth's atmosphere. All data are stored in units of watts/m-sq.

124 DNM      DIRECT NORMAL RADIATION

That portion of the radiant energy received at the earth's surface direct from and on a surface normal to the sun. Direct radiation is measured by pyrheliometers. All data are stored in units of watts/m-sq.

125 DHZ      DIRECT HORIZONTAL INSOLATION

That component of the direct normal radiation received on a unit horizontal surface. Direct horizontal insolation is estimated from a model for the NWS station data or can be calculated from the direct normal radiation.

126 DIF      DIFFUSE HORIZONTAL INSOLATION

Radiation reaching the earth's surface after having been scattered from the direct solar beam by molecules or suspensoids in the atmosphere. Also referred to as sky radiation. It is estimated from a model for the NWS station data. All data are stored in units of watts/m-sq.

127 PHO      PHOTOMETER

A measure of the amount of daylight visible to the human eye. This is essentially a pyranometer output filtered to approximate the sensitivities of the human eye.

128 DEW      DEW POINT TEMPERATURE

The temperature to which a given parcel of air must be cooled at constant pressure and constant water-vapor content in order for saturation to occur. Dew point temperature is stored in units of Degrees Kelvin.

129 WET      WET BULB TEMPERATURE

The temperature an air parcel would have if cooled to saturation by evaporation of water into the parcel, without loss of heat from the parcel and at constant pressure. Wet bulb temperature is stored in units of Degrees Kelvin times ten.

130 OHM      OUTDOOR RELATIVE HUMIDITY

The ratio of the actual vapor pressure of the air to the saturation vapor pressure. At the ELCAP sites, the sensing element is a thin polymer film that absorbs/desorbs atmospheric water vapor, changing the dielectric constant of the capacitance of the element. Units of relative humidity are percent.

131 STP      STATION PRESSURE

The atmospheric pressure computed for the level of the station elevation. Atmospheric pressure is stored in units of millimeters of mercury. Standard atmospheric pressure is 760 mm Hg.

