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Definition of terms
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Total energy use in buildings
analysis and evaluation methods

Final Report Annex 53

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Volume I
Definitions of terms

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Definitions for basic items related to building energy use: Energy boundary

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List of Symbols/Abbreviations

E_b: Energy actually required (namely net energy need) within the building space for space heating, cooling, and domestic hot water in a building;

E_t: Energy delivered to the technical systems in a building;

E_d: Energy delivered to the central plant of the district heating and cooling systems.

c: calorific value approach

p: primary energy approach

ee: electricity equivalent approach

N/A: Not Applicable

General definition

Total energy use is the total of all delivered energy by each carrier into the building boundary. For comparison of relative energy performance between buildings and data sets, the amount of energy delivered by each individual carrier shall be provided, prior to the application of any conversion factors. When the energy use of a building is presented in kWh/e meter (as is often the case), the term must be clarified in one of the following ways: (1) the building is all-electric,(in which case the value of Kwh/square meeting is unambiguous): (2) in addition to KWh/m2, fossil fuels are reported in common energy units for each fuel type (MJ, KBtu/m2 or (less desirable) in volumetric units for individual fuels. It is understood that terms such as kWh/m2 or MJ/m2 refers to the quantity of energy consumed in one year unless otherwise noted. (In addition to reporting each energy form separately, it is often useful to combine them into a common unit of KWh/m2; when this is done, the electricity from fossil fuel must reflect the conversion losses in electricity generation.)

1. Energy boundary

Purpose:
Since the main subject of Annex 53 is total energy use in buildings, the first thing for us to do is to define the three boundaries of energy consumption in buildings, which serves the base for the energy analysis. During the process of dealing with building energy consumption, it is necessary to indicate what boundary definition is used for the energy data.

As shown in Figure 1-1, the three boundaries are:

- E_b: Energy actually required (namely net energy need) within the building space for space heating, cooling, and domestic hot water in a building;
- E_t: Energy delivered to the technical systems in a building;
- E_d: Energy delivered to the central plant of the district heating and cooling systems.

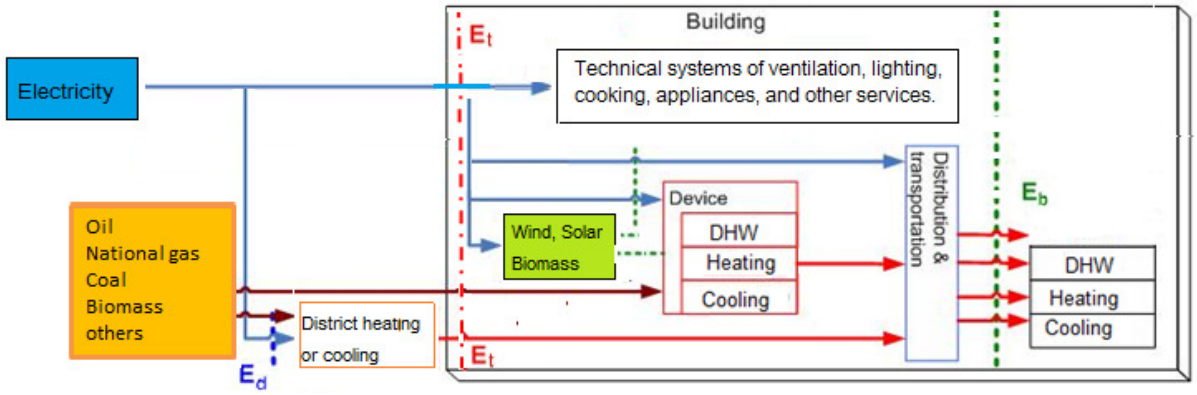

Figure 1-1 Energy boundaries

Detailed definition on energy boundary:

(1) E_b: define b=building needs

E_b is the energy actually required (namely net energy need) within the building space for the occupant's activities in a building through various end uses, considered from the energy demand side;

E_b for space heating & cooling. Sensible and latent heat or cold supplied to cover the actual needs for conditioning the building or room from a HVAC system. The actual needs are influenced by the actual thermostat settings chosen by the occupants. The heat or cold for conditioning the outdoor air delivered or infiltrated to the building is also within this boundary. Part of the recoverable heat or cold from the systems may be recovered in the building, thus reducing or augmenting the building energy needs for heating and/or cooling.
Energy for domestic hot water. The net energy demand can be calculated as the energy to heat the water from the temperature of local tap water to the temperature at the use site.

NOTE 1. As energy consumed for HVAC and domestic hot water has been counted as heat, the electricity for air-conditioners, for fans and pumps served to HVAC system, and domestic hot water heaters is not counted here but in E_t.

(2) E_t: Energy delivered to the technical systems of one building, usually considered from the energy supply side.

E_t for space heating & cooling means the energy delivered to AC system inside the building to produce heat and cool as the energy delivered to the building.
If the building is served by a district system, E_t refers to the energy delivered, at the level of the building boundary, for space heating and cooling.

NOTE 1: If there is a power generator in the building that consumes natural gas and produces its own electricity, only the natural gas should be the energy delivered to the technical system.

NOTE 2: If the building is served by a district heating/cooling system, E_t(HVAC) or E_t(hot water) should be the heat delivered to the building plus energy for distribution and transportation inside the building.

Energy delivered to the technical system for heating and cooling serving one building, it can be divided into two parts: energy for energy generation and energy for distribution.

Energy for energy generation: Energy delivered to heat and cool sources to produce heating and cooling. Energy for fans or pumps on the heat and cool source sides should also be part of the energy. Energy consumed for humidification and dehumidification is part of this item during space heating or cooling. Energy used to process the fresh air in outside air unit should be included in this part.

Energy for distribution system of space heating& cooling: Energy for pumps and fans for hot/chilled water circulation and for heating/cooling terminals. Energy for fresh air fans (this part of air should be conditioned) and heat recovery devices in air conditioning systems should also be included here as the auxiliary energy.

E_t for domestic hot water means the energy delivered to the domestic hot water system inside the building to heat the water and to transport/circulate the water.
If the building is served by a district heating/cooling system, E (hot water) should be the heat delivered to the building plus energy for distribution and transportation inside the building.

E_t for ventilation means energy used to drive ventilation appliances for air transport and heat recovery (not including energy input for preheating the air) and energy input to the humidification/dehumidification appliances to satisfy the need for humidification/dehumidification during the ventilation.
NOTE 1: Energy for ventilation fans of central air conditioning systems in the transition seasons (this part of air will not be required for air conditioning), should be included in the E(ventilation).

E_t for cooking means energy delivered to the building or rooms to drive the cooking appliances.

E_t for lighting means energy delivered to the building or rooms to drive lighting.

E_t for appliances means energy delivered to the building or rooms to drive the domestic/office appliances.

E_t for other services means energy delivered to the building or rooms to drive other appliances besides the above.

Active renewable energy generated on site refers to the energy generated by renewable devices attached to the buildings, such as the electricity from PV panels or wind, heat from solar thermal devices, etc. The energy used by the building technical systems is from grid electricity, district heat and cooling, renewable and non-renewable fuels, and on site renewable energy (without fuels). If the amount of on-site renewable energy is larger than that of the fossil energy, the building may become a "zero" or "positive" energy building.

(3) E_d: E_d specially aims at the energy use of space heating, cooling and hot water in district heating and cooling systems, usually considered from the energy supply side.

The energy delivered to the central plant such as boilers, chillers or CHPs for district heating or cooling or DHW is E_d. The energy for running the auxiliary equipment such as pumps and fans in the plant is also considered into E_d. The output from the central plant, in term of the heat in steam or circulated hot water, cold in circulated chilled water, is the part of the energy delivered to building technical system. However the energy for driving the auxiliary equipment such as fans and pumps in the central plant should not be part of the E_t, but be part of the E_d.

Table 1-1 defines the three energy boundaries for each kind of end use in detail. The components of each end use in each boundary are specified.

Finally, there is one thing to note: please take into account the conversion factor of Part 1.2 when adding the different consumptions in the same boundary, which have to be expressed in equivalent terms as explained later.

Table 1-1 Definition of energy boundaries for each end use

End uses	Heating	Cooling	Hot water
Energy boundary of E_b	Total heat gained for thermal comfort	Total cool gained for thermal comfort	Heat required to raise the water temperature from the tap water temperature to use site temperature
	Includes sensible & latent heat	Includes sensible & latent heat	Includes heat recovery

<table>
<tr><td></td><td colspan="2">Includes heat for fresh air through infiltration</td><td colspan="2">Includes cooling for fresh air through infiltration</td><td colspan="2"></td></tr>
<tr><td></td><td colspan="2">Includes heating for outdoor air handling</td><td colspan="2">Includes cooling for outdoor air handling</td><td colspan="2"></td></tr>
<tr><td></td><td colspan="2">Includes heat recovered to preheat the air input</td><td colspan="2">Includes cooling recovered to lower the heat input</td><td colspan="2"></td></tr>
<tr><td rowspan="6">Energy boundary of E_t</td><td>Energy to inlet of technical systems</td><td>District heating system: heat delivered to the inlet of building</td><td>Energy to inlet of technical systems</td><td>District cooling system: cold delivered to the inlet of building</td><td>Energy delivered to the domestic hot water system</td><td>District heating system: the heat delivered to the building</td></tr>
<tr><td colspan="2">Include energy for distribution and transportation in the building</td><td colspan="2">Include energy for distribution and transportation in the building</td><td colspan="2">Include energy for distribution and transportation in the building</td></tr>
<tr><td>Include energy loss in energy generation devices and in transportation process</td><td>Include energy loss in transportation process in the building</td><td>Include energy loss in energy generation devices and in transportation process</td><td>Include energy loss in transportation process in the building</td><td>Include energy loss in energy generation devices and in transportation process</td><td>Include energy loss in transportation process in the building</td></tr>
<tr><td colspan="2">Include energy for humidification</td><td colspan="2">Include energy for dehumidification</td><td colspan="2"></td></tr>
<tr><td colspan="2">Include energy used by heat recovery devices</td><td colspan="2">Include energy used by heat recovery devices</td><td></td><td></td></tr>
<tr><td colspan="6"></td></tr>
<tr><td rowspan="4">Energy boundary of E_d</td><td colspan="2" rowspan="2">Energy consumed by the central plant for space heating</td><td colspan="2" rowspan="2">Energy consumed by the central plant for space cooling</td><td colspan="2">Energy consumed by the central plant for water heating.</td></tr>
<tr><td colspan="2">NOTE: If heat is produced by building combined renewable sources, E_t counts only the auxiliary devices.</td></tr>
<tr><td colspan="6">Include energy for energy generation systems and all auxiliary devices in central plant side for space heating, cooling and hot water respectively.</td></tr>
<tr><td colspan="6">NOTE 1: For combined heating and cooling system, or system provides heat and DHW in the same time, E_d for space heating, and DHW is shared by the services provided.</td></tr>
</table>

	NOTE 2: If we calculate the Ed of space heating, cooling and hot water for one building in district heating or cooling system, we should prorate the energy use of heat/cool sources, fans and pumps in the plants for this analyzed building from other buildings.
	NOTE 3: If we compare the energy of Building A served by a central system with Building B in a district heating and cooling system, we should use the Et of building A and Ed of building B for comparison, but the transportation energy in the first pipe net should be subtracted from Ed for comparison.

End uses	Ventilation	Cooking	Lighting	Appliances	Other services
Energy boundary of E_t	Energy input to a ventilation system for air transport and heat recovery (not including energy input for preheating the air) and energy input to the humidification/ dehumidification appliances during ventilation.	Energy input to cooking appliances	Energy input to lighting appliances	Energy input to appliances providing services	Energy input to other appliances providing other services

2. Conversion factors

2.1 Presentation of measured energy use of buildings

The net energy demand E_b is generally not measurable by meters. At an individual building level, the only term which can be measured is the energy delivered to the technical equipment E_t. The consumption of the district heating and cooling plant is sometime also known. The presentation of the energy use data shall follow the means shown in Part 1.1.

2.2 Presenting energy use of buildings with original data

Both the type and quality of the energy source shall always be presented according to actual energy use, e.g. 1 m^3 (natural gas), 1 kWh (electricity).

2.3 Presenting energy use of buildings with conversion approaches

The actual energy use shall be converted into equivalent carriers along with a certain conversion approach which also shall be specified meanwhile when presenting energy use of buildings. There are three main conversion approaches, including calorific value approach, primary energy approach and electricity equivalent approach.

The calorific value approach is based on the heat included in the energy carriers, and this approach is usually used for the presentation of site energy, especially for electricity.

The primary energy approach traces the heat of the original energy resources. There is no difference between the calorific value approach and the primary energy approach for natural gas, oil, coal, gasoline, kerosene, and diesel oil, as these energy resources are all primary energy. However,

electricity is an exception. When electricity is converted to primary energy for the energy amount, conversion coefficient should be considered and reported.

When considering the capacity of different energy resources to do work, the electricity equivalent approach can be used.

The latter two presenting modes can be used when various energy carriers are required to be summed for total building energy use, or divided and normalized to calculate energy use per unit of floor area. When multiple fuels are combined into a total energy use, for calculating the total energy intensity, the conversion factors used should always be noted.

The conversion approach should be selected according to the purpose of energy analysis.

The subscript "c" shall be used when the calorific value approach is adopted, e.g. kWhc, GJc. The subscript "p" shall be used when the primary energy approach is adopted, e.g. kWhp, GJp, kgcep. The subscript "ee" shall be used when the electricity equivalent approach is adopted, e.g. kWhee, GJee.

Table 1-2 Energy conversion factors of the three conversion approaches Energy Carriers

Energy Carriers	**Amount**	**Calorific value approach**	**Primary energy approach**	**Electricity equivalent approach**	
		MJc	**MJp**	**MJee**	**Temperature**
Natural Gas	1 m^3	35.81[a] (33.82 ~37.80)	35.81[a] (33.82 ~37.80)	23.60 [a] (22.29 ~24.91)	CT: 1773K Ref. T: 273K
Crude Oil	1 kg	43.56 [a] (41.87 ~45.26)	43.56 [a] (41.87 ~45.26)	28.71 [a] (27.59 ~29.83)	CT: 1773K Ref. T: 273K
Coal	1 kg	23.66 [a] (18.46 ~28.85)	23.66 [a] (18.46 ~28.85)	11.92 [a] (9.30 ~14.54)	CT: 973K Ref. T: 273K
Liquefied petroleum gas	1 kg	47.08 [b] (46.01 ~47.69)	47.08 [b] (46.01 ~47.69)	31.02 [b] (30.32 ~31.43)	CT: 1773K Ref. T: 273K
Motor Gasoline	1 kg	44.55 [b] (44.00 ~44.80)	44.55 [b] (44.00 ~44.80)	29.36 [b] (29.00 ~29.52)	CT: 1773K Ref. T: 273K
Kerosene	1 kg	43.38 [b] (42.92 ~43.79)	43.38 [b] (42.92 ~43.79)	28.59 [b] (28.28 ~28.86)	CT: 1773K Ref. T: 273K
Gas/diesel oil	1 kg	42.76 [b] (42.58 ~43.29)	42.76 [b] (42.58 ~43.29)	28.18 [b] (28.06 ~28.53)	CT: 1773K Ref. T: 273K
Fuel oil	1 kg	40.74 [b] (39.98 ~42.58)	40.74 [b] (39.98 ~42.58)	26.85 [b] (26.35 ~28.06)	CT: 1773K Ref. T: 273K
Hot Water (95ºC/70ºC)	1 MJ	1	1	0.2317	Ref. T: 273 K

Hot Water (50ºC/40ºC)	1 MJ	1	1	0.1414	Ref. T: 273 K
Steam (0.4MPa)	1 MJ	1	1	0.3446	Ref. T: 273 K
Steam (0.3MPa)	1 MJ	1	1	0.3283	Ref. T: 273 K
Chilled Water (7ºC/12ºC)	1 MJ	1	1	0.07256	Ref. T: 303 K
Electricity	1 kWh	3.6	10.91 c	3.6	—
a) Average value of the selected country-specific net calorific values, with minimum and maximum values in the bracket. Source: Key World Energy Statistics, International Energy Agency, 2010;					
b) Average value of the default net calorific values of oil products, with minimum and maximum values in the bracket. Source: Key World Energy Statistics, International Energy Agency, 2010;					
c) Large difference among countries, the value in the table is calculated assuming a 33% conversion efficiency;					
CT: Combustion Temperature					
Ref. T: Reference Temperature					

It is meaningful to use different methods to convert different energy sources in a uniform way, but the value of conversion factor should vary from country to country according to fuel property. Many countries have their unique conversion factors depending on the averaged or typical fuel property in the country. Therefore, it is suggested to use the conversion factors above as an optional example, and to allow each country to use their unique (local) conversion factors. Electricity should be dealt with the same philosophy. Fuels and electricity consumed in the building should be converted with factors of used fuel and electricity properties. To that point, using unique (local) conversion factors in each country is a favorable way to know the real value of energy used in the building.

3. Energy performance indicators

Building energy use can be expressed using the following three energy performance indicators.

Step 1: energy carrier

Energy use data needs to be provided for electricity, gas, oil, fossil fuel and renewable energy separately as the first step.

Table 1-3 energy performance indicators for step 1 of energy carrier

Name of parameter	**Original Unit**	**Standard unit**
a) Fuel Consumption	m^3 or kg	MJ, GJ in calorific value
b) Electricity Consumption	kWh	MJ, GJ in calorific value
c) Cooling consumption	GJ	MJ, GJ in calorific value
d) Heating consumption	GJ	MJ, GJ in calorific value

Step 2: Aggregation of energy

The energy carriers have to be combined in order to express the energy consumption through an "aggregated and synthetic" energy parameter for different times and different zones of buildings, as follow:

- Primary energy (Ep)
- Equivalent electricity (Eee)

Table 1-4 energy performance indicators for step 2 of aggregation of energy

Name of parameter	**Units**
a) Primary Energy (Ep)	MJ, GJ
b) Equivalent electricity (Eee)	kWh_{ee}

Step 3: Factors relating to energy performance indicators

The energy parameters defined in Step 1 and 2 can be normalised by the following factors in order to obtain general and comparable results from different buildings, in different time, etc.

Table 1-5 energy performance indicators for step 3 of factor normalization

Indices used for normalization	Form
a) Geometrical factors where Sn [m^2] = floor area and Sw [m^2] = conditioned floor area	1) For electricity consumption= kWh/ m^2, per year or month
	2) For primary energy consumption = GJ/m^2
b) Number of occupants	1) For electricity consumption = kWh/person, per year or month
	2) For primary energy consumption = GJ/person
c) Number of occupancy hours	1) For electricity consumption = kWh/h, per year or month
	2) For primary energy consumption = GJ/h
d) Climate factor: HDD, CDD	For fuel consumption = kWh/HDD, per heating season
e) Same factors combined	For primary energy for heating = GJ/DDh m^2

4. Definition of terms: end uses

- The end uses of residential buildings include: space heating, space cooling, ventilation, domestic hot water, cooking, domestic appliances, lighting, and others (elevators, security monitors, etc.).
- The end uses of office buildings include: space heating, space cooling, ventilation, lighting, appliances, and others (cooking, domestic hot water, elevators, security monitors, etc.).
- When we talk about end use, we must indicate which energy boundary this end use is corresponding to. Part 1.1 of the energy boundary section also includes some definitions of different end uses, so the overlapping contents are not duplicated here. Please refer to Part 1.1 to fully understand the definition of end uses.

Table 1-6 Building energy use categorized according to E_d, E_t and E_b boundaries

End Use	E_d	E_t	E_b	Residential building	Office building
1) Energy for space heating	Energy delivered to the central plant for space heating	Energy delivered to the heating system of the building for space heating	Heat delivered into the building space	X	X
2) Energy for space cooling	Energy delivered to the central plant for space cooling	Energy delivered to the cooling system of the building for space cooling	Cooling energy delivered into the building space	X	X
3) Energy for ventilation	N/A	Energy for ventilation	N/A	X	X
4) Energy for lighting	N/A	Energy for lighting	N/A	X	X
5) Energy for domestic or office appliances	N/A	Energy for domestic/office appliances	N/A	X	X
6) Energy for domestic hot water	Energy delivered to the central plant for domestic hot water	Energy delivered to the heating system of the building for domestic hot water	Heat delivered to domestic hot water	X	N/A
7) Energy for other appliances	N/A	Energy for other appliances, such as elevators/escalators, security monitors, etc.		X	N/A
8) Energy for other appliances	N/A	Energy for other appliances, such as cooking, domestic hot water, elevators, security monitors, etc.		N/A	X

I-2

Three level data typologies for residential buildings

Contents

Introduction

The main purpose of the three level typologies definitions for residential buildings is to define the influencing factors of energy use of the residential buildings Hence, it is important to figure out the influencing factors of each end use of residential buildings, and to work out what kinds of parameters should be used to describe and quantify these influencing factors.

The tree diagrams below show examples of the main factors influencing space cooling, and ventilation in residential buildings, and the parameters used to define these influencing factors. As shown in Figure 2-1, the influencing factors of space cooling include the climate, building envelope and other characteristics, building services and energy systems, building operations, occupant's behavior, and indoor environment. The weather data with the HDD (heating degree day) and CDD (cooling degree day) can be used to quantify the climate, and used to analyze the influence of climate on space cooling energy use. The thermal performance of the envelopes, air tightness and floor areas are used to define the properties of building characteristics. The number of air conditioners and their performance parameters can be used to describe the influence of building appliances on space cooling energy use. Similarly, the schedule, control and set point of air conditioners, and the schedules and controls of window opening and shading are the key parameters to describe and quantify the building operation and occupant behavior. These parameters are used to analyze the influences of building operation and occupant behavior on space cooling energy use. Finally, thermal environment is also an important factor.

In the three level typologies definitions for residential buildings, all the influences factors of the end uses for residential buildings are figured out and classified into the six categories, and each level covers its corresponding categories, as listed in the table titled with *Three Level Typology Definitions*, in the main body of ST_A. Besides that, as single family house and apartment buildings have different energy use characteristics and influence factors, three level typologies definitions are developed for each kind of residential buildings respectively, with six sets of definitions totally, and there are differences in the item definitions between single family houses and apartment buildings.

As clarified in the main body of ST_A, the simple level serves for the statistical analysis with large dataset, and hence it covers the least parameters, while the intermediate level is used for case studies, the items defined in this level is more than simple level, and the complex level has the most comprehensive and most complicated item definitions, as is serves for simulation and detail diagnosis. When the statistical analysis or the case study or simulation is conducted, some of the items or all the items in its corresponding level can be selected and used in the analysis. In each level, all the defined influence factors and items are indicated as primary important or secondary important, which means the items with the primary importance have larger influences on energy use or are the more fundamental factors in this kinds of analysis, and hence they are suggested to firstly choose for analysis. Besides that, in the complex level, the parameters needed in the simulation models or embodied in the simulation tools are also indicated, which means that these parameters can be used in simulation, and their values should be gotten when a simulation is made.

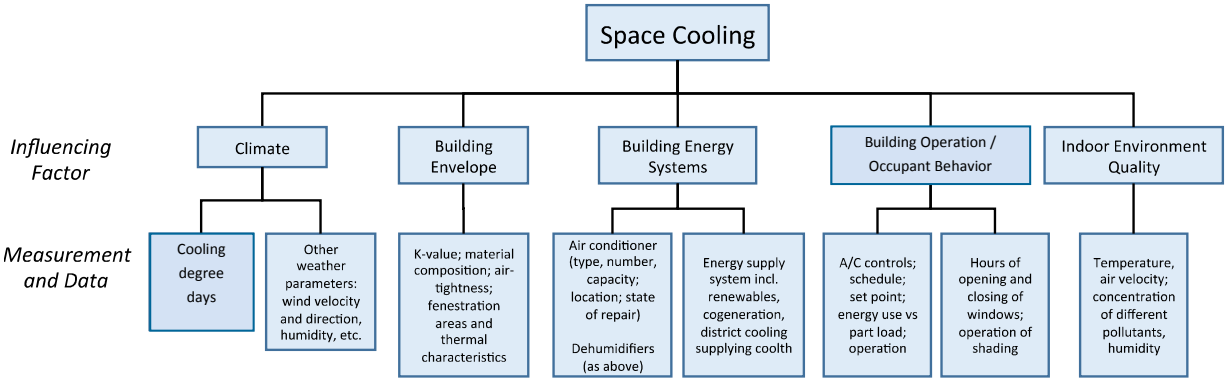

Figure 2-1 Influencing factors related to space cooling

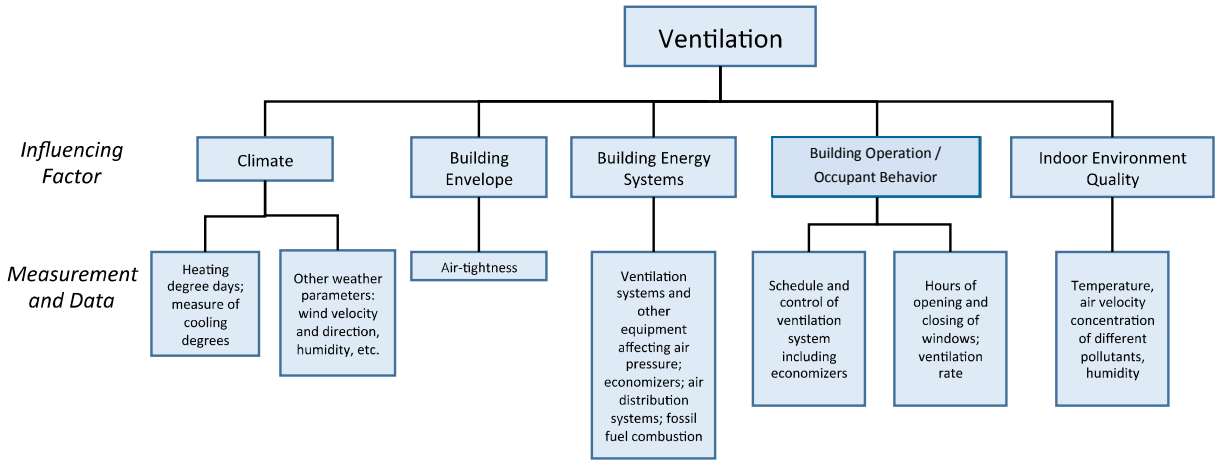

Figure 2-2 Categories of influencing factors related to ventilation

List of Symbols/Abbreviations

PI: Primary Importance
SI: Secondary Importance
Y: Yes
N: No
N/A: Not Applicable
SF: single family
MF: multi-family

1. Simple version for residential buildings – Level A database

In the simple version, principal drivers related to the influencing factors of energy use in the categories of climate, whole building characteristics, building envelope, building services and energy systems, building operation and inputs for the energy systems are defined.

1.1 Climate

Table 2-1 Item definitions for climate in Level A

Code	Item	Definition	Frequency	SF	MF
1.1.1	HDD and CDD	Indicate the heating degree days and cooling degree days and the reference temperatures used.	Monthly or annual	PI	PI

1.2 Whole building characteristics

Table 2-2 Item definitions for whole building characteristics in Level A

Code	Item	Definition	SF	MF
1.2.1	Year built	Indicate the year built by selecting one of the following categories: 1) Before 1920; 2) 1920 to 1945; 3) 1946 to 1959; 4) 1960 to 1969; 5) 1970 to 1979; 6) 1980 to 1989; 7) 1990 to 1999; 8) 2000 to 2009; 9) After 2009.	SI	SI
1.2.2	Number of floors	Indicate the number of floors above ground and underground.	SI	SI
1.2.3	Conditioned and/or heated floor area	The floor area (m^2) of conditioned floor space, as measured at the floor level within the external surfaces of walls enclosing the conditioned space. It includes the attached space, such as basement, attic, if they are conditioned. Indicate the exact conditioned and/or heated floor area –OR– select from one of the following percentages for both cooling and heating. For cooling: 1) Not cooled; 2) 1-50%; 3) 51 to 99%; 4) 100%. For heating: 1) Not heated; 2) 1-50%; 3) 51 to 99%; 4) 100%.	PI	PI
1.2.4	Gross floor area	Gross floor area is calculated including external walls of the house or building. The attached space should also be included, such as basement, attic, etc.	PI	PI
1.2.5	Number of occupants	The number of occupants each family has	SI	SI
1.2.6	Gross floor area of each unit	Gross floor area is calculated including external walls. The attached space should also be included, such as basement, attic, etc.	N/A	PI
1.2.7	Type of building	Indicate the type of building: OR1) Single family; Condo3) Apartment; 4) Mobile home; 5) Studio; 6) Duplex; 7) Triplex;	N/A	PI

		8) Four-plex; 9) Condo; 10) Town home; 11) terraced house; 12) building complex; 13)Other		
1.2.8	Building activity areas	Select one or more of the following:1)Living room, 2)bedroom; 3)stairwell; 4)corridor, 5)basement, 6)garage, 7)attic, 8) vacant; 9)others For building complex, maybe including 1) food sales/food service, 2)shopping mall/retail, 3)warehouse/storage,4) other)	N/A	SI
1.2.9	Number of units		N/A	SI

1.3 Building envelope

Table 2-3 Item definitions for building envelope in Level A

Code	Item	Definition	SF	MF
1.3.1	Material	This includes walls, ceiling, floor, and window material. • Wall material (select one): 1) Brick, stone or stucco; 2) Concrete; 3) Concrete panels; 4) Siding or shingles; 5) Metal panels; 6) Curtain glass; 7) Other • Walls insulated (Y/N?) • Roof material (select one): 1) Brick 2) Concrete; 3) Concrete panels; 4) Stone; 5) Wood; 6) Other • Roof insulated (Y/N?) • Window material o Select one frame type: 1) Aluminium, 2) Plastic steel; 3) Steel, 4) Wood; 5) Other o Select number of panes: 1) Single; 2) Double; 3) Triple; 4) Other o Select one glass type: 1) Flat glass; 2) Insulating glass; 3) Insulating glass-AR; 4) Insulating glass-KR; 5) Low -e; 6) Solar protection glass; 7) Other Select the percentage of operable windows: 1) Not operable; 2) Less than 10%; 3) 10%-30%; 4) 30%-60%; 5) More than 60%	SI	SI
1.3.2	U-value	Provide for all of the building envelope components (wall, ceiling, windows, etc.) using the units: w/(m2*k).	PI	PI
1.3.3	Window to wall ratio	Select one of the following: 1) 25 % or less; 2) 25%-35%; 3) 35%-45%; 4) more than 45%. This should exclude the roof area.	PI	PI

1.4 Building services and energy systems

Building services and energy systems include space heating system, air conditioning system, ventilation system, lighting, domestic hot water, cooking appliances, domestic appliances, and others. In the simple version, we just need to record the following information, including whether these systems are centralized or decentralized systems, and the type, fuel type, heat capacity, total power. Centralized systems usually refer to the systems serving the whole buildings or the whole single attached houses, while decentralized appliances usually only used in individual rooms.

Table 2-4 Item definitions for building service and energy systems in Level A

Code	Item	Definition				SF	MF
1.4.1	Space heating - centralized	Type of space heating system (Select one: 1) District steam hot water; 2) Boilers inside the building; 3) Other)	Fuel type	Total power (w)	Heat capacity of the building (w)	PI	PI
1.4.2	Space heating - decentralized	Type of space heating system (Select one or more: 1) Individual space heaters; 2) Furnaces; 3) Other)	Fuel type	Total power (w)	Heat capacity (w)	PI	PI
1.4.3	Air conditioning - centralized	Type of space cooling system (Select one or more: 1) District chilled water; 2) Heat pump; 3) Central chillers; 4) Evaporative coolers; 5) residential central air conditioning, usually used for single family houses; 6)Other	Fuel type	Total power (w)	Heat/ cooling capacity (w)	PI	PI
1.4.4	Air conditioning - decentralized	Type of space cooling system (Select one or more: 1) Individual room A/C; 2) Other)	Fuel type	Total power (w)	Heat/ cooling capacity (w)	PI	PI
1.4.5	Ventilation	Type of local fans		Total power (w)		PI	PI
1.4.6	Lighting	Types of lighting (Select one or more: 1) Incandescent bulbs; 2) Fluorescent bulbs; 3) Compact fluorescent bulbs; 4) LEDs; 5) Other)		Total power (w)		SI	SI
1.4.7	Domestic hot water - centralized	Type of centralized hot water system (Select one: 1) District hot water; 2) Central hot water system in the building or the single family house; 3) Other)	Fuel type	Total power (w)	Heat capacity of the building (w)	PI	PI

1.4.8	Domestic hot water - decentralized	Type of decentralized hot water system	Fuel type	Total power (w)		PI	PI
1.4.9	Cooking	Type(s) of appliances used for cooking (Select one or more: 1) Oven; 2) Cooktop; 3) Microwave; 4) Coffee maker; 5) Toaster oven; 6) Refrigerator; 7) Separate freezer; 8) Dishwasher; 9) Toaster; 10) Other)	Fuel type	Total power (w)		SI	SI
1.4.10	Domestic appliances	Type(s) of appliances • Entertainment – Select or more: 1) TV; 2) VCR/DVD; 3) Stereo system; 4) Computer & related electronics; 5) Telephone/fax; 6) Printer/scanner; 7) Portable, rechargeable devices; 8) Other • Housework and health: 1) Clothes washer; 2) Clothes dryer; 3) Iron; 4) Vacuum; 5) Dehumidifier /humidifier; 6) Other		Total power (w)		SI	SI
1.4.11	Other	Types of other equipment used in the building (Select one or more: 1) Elevator; 2) Security monitors; 3) Other)	Fuel type	Total power (w)		N/A	SI

1.5 **Building operation**

Use occupancy schedule to describe building operation.

Table 2-5 Item definitions for building opeartion in Level A

Code	Item	Mode	Schedule	SF	MF
1.5.1	Occupancy schedule	N/A	Hours one or more people are at home on weekdays/weekends	SI	SI
1.5.2	Space heating	Select one of the following modes: 1) Full space, full time; 2) Full	Provide the number of weeks used in	SI	SI

		space, only occupied time; 3) Only occupied space, full time; 4) Only occupied space, only occupied time.	summer and winter		
1.5.3	Space cooling	Select one of the following modes: 1) Full space, full time; 2) Full space, only occupied time; 3) Only occupied space, full time; 4) Only occupied space, only occupied time.	Provide the # of weeks used in summer and winter	SI	SI
1.5.4	Ventilation	Select one of the following modes: 1) Full space, full time; 2) Full space, only occupied time; 3) Only occupied space, full time; 4) Only occupied space, only occupied time.	Provide the daily range of running hours	SI	SI
1.5.4	Lighting	Select one of the following modes: 1) Full space, full time; 2) Full space, only occupied time; 3) Only occupied space, full time; 4) Only occupied space, only occupied time.	Provide the daily range of running hours	SI	SI
1.5.5	Cooking	N/A	Provide the average hours per week	SI	SI
1.5.6	Domestic hot water	Select one of the following for time mode: Water heating is turned on full time or part time (only when at home).	Provided the times of use per week and minutes per session	SI	SI
1.5.7	Domestic appliances (Only for TV/ computer/ refrigerator)	N/A	Provide the number of hours per week per appliance	SI	SI

1.6 **Input into energy performance indicators**

Building energy use can be expressed in three ways according to Appendix 1, which are:
(1) Energy use of each energy resource,
(2) Aggregation of energy of primary energy, equivalent electricity,
(3) Normalized energy use in the above two approaches

Table 2-6 Item definitions for energy performance indicators in Level A

Code	Item	Definition	Frequency	Scope	SF	MF
1.6.1	Step 1: Energy carrier	Indicate the energy use of each energy resource.	Monthly (preferred) or annual (acceptable)	For multi-family: per unit (preferred) or whole building (acceptable)	SI	SI
1.6.2	Step 2: Aggregatio	Provide the aggregation of	Monthly (preferred) or	For multi-family: per unit (preferred) or	PI	PI

	n of energy	energy of primary energy, equivalent electricity.	annual (acceptable)	whole building (acceptable)		
1.6.3	Step 3: Normalized energy use	Normalized energy use.	Monthly (preferred) or annual (acceptable)	For multi-family: per unit (preferred) or whole building (acceptable)	PI	PI

1.7 Indirect factors (OPTIONAL)

The following definitions of indirect factors are suggestions for key indirect factors that influence energy use suitable for single detached houses and multi-family apartment buildings.

Table 2-7 Item definitions for indirect factors in Level A

Code	Category	Parameter	Description	SF	MF
1.7.1	Family factors	Income per household/person	Annual income divided by the number of family members given in US$.	SI	SI
1.7.2		Age of each family member	N/A	SI	SI
1.7.3		Gender of each family member	N/A	SI	SI
1.7.4	Energy-related attitude of occupants	Concern for saving energy	Subjective assessment of consciousness of occupants of energy conservation: 1) Very concerned; 2) Concerned; 3) Indifferent; 4) Not so concerned; 5) Not concerned at all	SI	SI
1.7.5	Thermal environmental satisfaction of occupants	Satisfaction of thermal environment	Subjective assessment of thermal environment: 1) Very satisfied; 2) relatively satisfied; 3) indifferent; 4) relatively disatisfied; 5) very disatisfied.	SI	SI

2. Intermediate version for residential buildings – Level B database

The intermediate version is more detailed and includes more items, when compared with the simple version. It defines the influencing factors of seven categories: climate, indoor thermal environment, building characteristics, building envelope, building service and energy system, building operation, and indirect factors. In each category, the important items that affect energy use are listed and defined.

2.1 Climate and indoor thermal environment

The following table lists the items used to describe the climate and indoor thermal environment. For each item, the measured frequency and location are defined.

Table 2-8 Item definitions for climate and indoor thermal environment in Level B

Code	Item	Frequency	Location	SF	MF
2.1.1	HDD and CDD	Monthly or annual	N/A	PI	PI
2.1.2	Weather data	Daily or monthly (Indicate if hourly weather data are available (yes/no))	Provide weather data including ambient temperature, humidity, and direct/diffuse solar radiation at the nearest weather station.	SI	SI
2.1.3	Indoor temperature (°C)	Daily or daily indoor temperature of typical days on weekdays/weekends in each season	Indicate the measured indoor temperature in rooms frequently occupied, measured when someone is at home and when no one is at home.	PI	PI
2.1.4	Indoor humidity	Daily or daily indoor humidity of typical days on weekdays/weekends in each season	Indicate the measured indoor humidity in rooms frequently occupied, measured when someone is at home and when no one is at home.	SI	SI

2.2 Whole building characteristics

Table 2-9 Item definitions for whole building characteristics in Level B

Code	Item	Definition	SF	MF
2.2.1	Year built	Indicate the year built by selecting one of the following categories: 1) Before 1920; 2) 1920 to 1945; 3) 1946 to 1959; 4) 1960 to 1969; 5) 1970 to 1979; 6) 1980 to 1989; 7) 1990 to 1999; 8) 2000 to 2009; 9) After 2009.	SI	SI
2.2.2	Number of floors	Indicate the number of floors.	SI	SI
2.2.3	Conditioned and/or heated floor area	The floor area of conditioned floor space, as measured at the floor level within the external surfaces of walls enclosing the conditioned space. It includes the attached space, such as basement, attic, if they are conditioned. Indicate the exact conditioned and/or heated floor area –OR– select from one of the following percentages for both cooling and heating. For cooling: 1) Not cooled; 2) 1-50%; 3) 51 to 99%; 4) 100%. For heating: 1) Not heated; 2) 1-50%; 3) 51 to 99%; 4) 100%.	PI	PI
2.2.4	Gross floor area for the whole building	Gross floor area is calculated including external walls of the entire house or building. The attached space should also be included, such as basement, attic, etc.	PI	PI

2.2.5	Number of occupants	N/A	SI	SI
2.2.6	Gross floor area of each unit	Gross floor area is calculated including external walls. The attached space should also be included, such as basement, attic, etc.	N/A	PI
2.2.7	Type of building	Indicate the type of building: OR1) Single family; Condo3) Apartment; 4) Mobile home; 5) Studio; 6) Duplex; 7) Triplex; 8) Four-plex; 9) Condo; 10) Town home; 11) terraced house; 12) building complex; 13)Other	SI	SI
2.2.8	Building activity areas	Select one or more of the following:1)Living room, 2)bedroom; 3)stairwell; 4)corridor, 5)basement, 6)garage, 7)attic, 8) vacant; 9)others For building complex, maybe including 1) food sales/food service, 2)shopping mall/retail, 3)warehouse/storage,4) other)	SI	SI
2.2.9	Number of units	N/A	N/A	SI
2.2.10	Gross floor area occupied by each activity	Provide floor area for all space/activity types listed in 2.2.8	SI	SI
2.2.11	Ownership	Indicate whether the home or apartment is: 1) rented; 2) owned; 3) a condominium; 4) a cooperative 5) public housing.	SI	SI
2.2.12	Orientation	Provide the orientation for each façade.	PI	PI

2.3 Building envelope and other components

Table 2-10 Item definitions for Building envelope and other components in Level B

Code	Item	Definition	SF	MF
2.3.1	Material	This includes walls, ceiling, floor, and window material. • Wall material (select one): 1) Brick, stone or stucco; 2) Concrete; 3) Concrete panels; 4) Siding or shingles; 5) Metal panels; 6) Curtain glass; 7) Other • Wall insulation material: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Batt; 5) Fiberboard sheathing; 6) Rockwool; 7) Other; 8) No insulation • Roof material (select one): 1) Brick 2) Concrete; 3) Concrete panels; 4) Stone; 5) Wood; 6) Other • Roof insulation material: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Batt; 5) Fiberglass; 6) Rockwool; 7) Others; 8) No insulation • Attic insulation material: 1) Fiberglass; 2) Rockwool; 3) Insulsafe; 4) Recycled cotton; 5) ISOCY; 6) Icynene; 7)	PI	PI

		Unknown insulation; 8) Other; 9) No insulation • Floor material (select one): 1) Brick; 2) Concrete; 3) Stone; 4) Stucco; 5) Other • Floor insulation material: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Other; 5) No insulation • Window material o Select one frame type: 1) Aluminum, 2) Plastic steel; 3) Steel, 4) Wood; 5) Other o Select number of panes: 1) Single; 2) Double; 3) Triple; 4) Other o Select one glass type: 1) Flat glass; 2) Insulating glass; 3) Insulating glass-AR; 4) Insulating glass-KR; 5) Low-e; 6) Other • Select the percentage of operable windows: 1) Not operable; 2) Less than 10%; 3) 10%-30%; 4) 30%-60%; 5) More than 60% • Shading system o Select one or more: 1) External overhangs; 2) Awnings; 3) Solar screens; 4) Solar film; 5) Other Indicate: 1) Exterior; 2) Interior; 3) Within glazing system/façade system 4) Other		
2.3.2	U-value	Provided for all of the building envelope components (wall, ceiling, windows, etc.) using the units: w/(m2*k)	PI	PI
2.3.3	Comprehensive shading coefficient of the windows	This coefficient considers the shading effects of both windows and exterior shading. It equals the shading coefficient of windows multiplied by the shading coefficient of exterior shading. This can also be solar factor.	SI	SI
2.3.4	Window to wall ratio	Select one of the following: 1) 25 % or less; 2) 25%-35%; 3) 35%-45%; 4) more than 45%. This should exclude the roof area.	PI	PI
2.3.5	Solar heat gain coefficient	Provide the solar heat gain coefficient of glazing	SI	SI

2.4 Building services and energy systems

Building service and energy systems here refer to the building technical systems, including space heating, air conditioning, ventilation, lighting, domestic hot water, cooking, domestic appliances and others, such as elevators and security monitors. Single detached houses usually use decentralized systems, while multi-family apartment buildings also use decentralized systems, except that some buildings have the district heating. Besides the information covered in the simple version, the number of each type of appliances should also be recorded.

Table 2-11 Item definitions for building services and energy systems in Level B

Code	Item	Definition					SF	MF
2.4.1	Space heating - centralized	Type of space heating system (Select one: 1) District steam hot		Fuel type	Total power (w)	Heat capacity of the building	PI	PI

		water; 2) Boilers inside the building; 3) Other)				(w)		
2.4.2	Space heating - decentralized	Type of space heating system (Select one or more: 1) Individual space heaters; 2) Furnaces; 3) Other)	Number of each type of heater	Fuel type	Total power (w)	Heat capacity (w)	PI	PI
2.4.3	Air conditioning - centralized	Type of space cooling system (Select one or more: 1) District chilled water; 2) Heat pump; 3) Central chillers; 4) Evaporative coolers; 5) Natural heat sink; 6) Residential central A/C; Other)		Fuel type	Total power (w)	Heat/ cooling capacity (w)	PI	PI
2.4.4	Air conditioning - decentralized	Type of space cooling system (Select one or more: 1) Individual room A/C; 2) Other)	Number of each type of equip.	Fuel type	Total power (w)	Heat/ cooling capacity (w)	PI	PI
2.4.5	Ventilation	Type of local fans	Fuel type		Total power (w)		PI	PI
2.4.6	Lighting (For both indoor and outdoor lighting)	Types of lighting (Select one or more: 1) Incandescent bulbs; 2) Fluorescent bulbs; 3) Compact fluorescent bulbs; 4) LEDs; 5) Other)	Number of bulbs		Total power (w)	Control method for common areas (photo/occupancy/scheduling)	PI	PI
2.4.7	Domestic hot water - centralized	Type of centralized hot water system (Select one: 1) District hot water; 2) Central hot water in the building; 3) Other)	Fuel type	Total power (w)	Heat capacity of the bldg. (w)	Control method (manual or automatic)	PI	PI
2.4.8	Domestic hot water - decentralized	Type of decentralized hot water system	Fuel type	Total power (w)		Size of hot water tank	PI	PI
2.4.9	Cooking	Type(s) of appliances used for cooking (Select one or more:	Fuel type	Total power (w)			PI	PI

		1) Oven; 2) Cooktop; 3) Microwave; 4) Coffee maker; 5) Toaster oven; 6) Refrigerator; 7) Separate freezer; 8) Dishwasher; 9) Toaster; 10) Other)						
2.4.10	Domestic appliances	Type(s) of appliances Entertainment – Select one or more: 1) TV; 2) VCR/DVD; 3) Stereo system; 4) Computer & related electronics; 5) Telephone/fax; 6) Printer/scanner; 7) Portable, rechargeable devices; 8) Other Housework and health – Select one or more: 1) Clothes washer; 2) Clothes dryer; 3) Iron; 4) Vacuum; 5) Dehumidifier /humidifier; 6) Other		Total power (w)	Energy efficient product or not		PI	PI
2.4.11	Other	Types of other equipment used in the building (Select one or more: 1) Elevator; 2) Security monitors; 3) Other)	Fuel type	Total power (w)			N/A	SI

2.5 **Building operation and human behavior**

The part below makes the definitions for building and technical system operation, including the occupancy, operation of technical systems, and the operation of windows, shading and curtains. T he operation of technical building systems us defined by three aspects: operation modes (space and time), operation schedule, and set points.

2.6 **Occupancy**

Table 2-12 Item definitions for occupancy in Level B

Code	Item	Space and time mode	Schedule	Set point	SF	MF

2.5.1	Occupancy schedule	N/A	Fraction of the nominal occupancy (value between 0 and 1) for each hour of weekday/weekend.	N/A	PI	PI

2.6.1 **Technical building systems**

Table 2-13 Item definitions for operation of technical building systems in Level B

Code	Item	Space and time mode	Schedule	Set point	SF	MF
2.5.1	Space heating	Select one of the following modes: 1) Full space, full time; 2) Full space, only occupied time; 3) Only occupied space, full time; 4) Only occupied space, only occupied time.	Provide the following: 1) # of weeks used in summer and winter; 2) When used, # of hours at night/daytime on weekday/ weekend, separately.	Provide the following: 1) Set point; 2) Range of set points; 3) If possible indicate set points when occupied and unoccupied.	PI	PI
2.5.2	Space cooling	Select one of the following modes: 1) Full space, full time; 2) Full space, only occupied time; 3) Only occupied space, full time; 4) Only occupied space, only occupied time.	Provide the following: 1) # of weeks used in summer and winter; 2) When used, # of hours at night/daytime on weekday/ weekend, separately.	Provide the following: 1) Set point; 2) Range of set points; 3) If possible, indicate set points when occupied and unoccupied.	PI	PI
2.5.3	Ventilation (mechanic) - Rooms	N/A	Provide the following: 1) Number of times fan used on weekday/weekend; 2) Minutes per use.	N/A	PI	PI
2.5.4	Ventilation (mechanic) - Basement/garage	Select one of the following modes: 1) Full space, full time; 2) Full space, only occupied time; 3) Only occupied space, full time; 4) Only occupied space, only occupied time.	Provide the following: 1) Number of times ventilation system used per day; 2) Minutes (single family) or hours (multi-family) per use; 3) Portion of appliances running (multi-family only).	Power level used (multi-family only)	PI	PI

2.5.5	Lighting	Select one of the following modes: 1) Full space, full time; 2) Full space, only occupied time; 3) Only occupied space, full time; 4) Only occupied space, only occupied time.	Provide the following: 1) Range of running hours; 2) Number of lights on when occupied and unoccupied.	N/A	PI	PI
2.5.6	Cooking	N/A	Provide the following: 1) Hours per weekday and weekend; or 2) # of times per day/week/month and minutes per use.	N/A	PI	PI
2.5.7	Domestic hot water	Select one of the following for time mode: 1) Water heating is turned on full time or part time (only when at home).	Provided the following: 1) Hours per day/week in each season, and litres per hour. 2) Times of use per week and minutes per session/litres per use.	Temperature at which hot water is maintained.	PI	PI
2.5.8	Domestic appliances	N/A	Provide the following: 1) Hours per weekday and weekend; or 2) # of times per day/week/month and minutes per use.	N/A	PI	PI
2.5.9	Other	N/A	Provide the following: 1) Range of running hours; 2) Portion of appliances running weekday and weekend.	N/A	N/A	SI

2.6.2 **Windows, shadings and curtains **OPTIONAL****

Table 2-14 Item definitions for occupant behaviour of windows, shadings and curtains use in Level B

Code	Item	Space and time mode	Schedule	Set point	SF	MF

2.5.11	Windows	N/A	Provide the following: 1) Times of use per day and minutes per use; 2) Hours open during day/night and week/weekend.	N/A	SI	SI
2.5.12	Curtains/blinds	N/A	Provide the following: 1) Times of use per day and minutes per use; 2) Hours open during day/night and weekday/weekend.	N/A	SI	SI

2.7 Input into energy performance indicators

Building energy use can be expressed in three ways, which are:

(1) Energy use of each energy resource, fuel, electricity, cooling and heating, and peak electric demand

(2) Aggregation of energy of primary energy, equivalent electricity

(3) Normalized energy use in the above two approaches

Table 2-15 Item definitions for energy performance indicators in Level B

Code	Item		Definition	Frequency	Scope	SF	MF
2.6.1	Step 1: Energy Carrier	Fuel consumption	Indicate fuel consumption in J, MJ, or GJ.	Daily or monthly	Per end use and per unit	PI	PI
2.6.2		Electricity consumption	Indicate electricity consumption in J, MJ or GJ.	Daily or monthly	Per end use and per unit	PI	PI
2.6.3		Cooling consumption	Indicate cooling consumption in J, MJ or GJ.	Daily or monthly	Per end use and per unit	PI	PI
2.6.4		Heating consumption	Indicate heating consumption in J, MJ or GJ.	Daily or monthly	Per end use and per unit.	PI	PI
2.6.5		Peak electric demand	Indicate peak electric demand in W or kW.	Daily or monthly	per unit	SI	SI
2.6.6	Step 2: Aggregation of Energy		Provide the aggregation of primary energy and equivalent electricity by the methodology provided in I-1.	Daily or monthly	per unit	PI	PI

2.6.7	Step 3: Normalized Energy Use	Factors related to energy performance indicators	Normalized energy use.	Daily or monthly	Per end use and per unit	PI	PI

2.8 Indirect factors (OPTIONAL)

The following definitions of indirect factors are suggestions for key indirect factors that influence energy use suitable for single detached houses and multi-family apartment buildings.

Table 2-16 Item definitions for indirect factors in Level B

Code	Category	Parameter	Description	SF	MF
2.7.1	Family factors	Income per household/person	Annual income divided by the number of family members given in US$.	SI	SI
2.7.2		Age of each family member		SI	SI
2.7.3		Gender of each family member		SI	SI
2.7.4	Energy-related attitude of occupants	Concern for saving energy	Subjective assessment of consciousness of occupants of energy conservation: 1) Very concerned; 2) Concerned; 3) Indifferent; 4) Not so concerned; 5) Not concerned at all	SI	SI
2.7.5	thermal environmental satisfaction of occupants	satisfaction of thermal environment	Subjective assessment of thermal environment: 1) Very satisfied; 2) relatively satisfied; 3)indifferent; 4) relatively disatisfied; 5)very disatisfied.	SI	SI

3. Complex version for residential buildings – Level C database

The complex level data typology is the highest level. It can serve for detail diagnosis and simulations. It defines the influencing factors of climate, indoor thermal environment, whole building characteristics, building envelope, building service and energy system, building operation, and input into energy performance indicators. The influencing factor categories include more items, and the item definitions are also more detailed, compared with the two levels above.

3.1 Climate and indoor environment

Table 2-17 Item definitions for climate and indoor environment in Level C

Code	Item	Frequency	Location	SF	MF	Parameter Used for Simulation (Y/N/?)

3.1.1	HDD and CDD	Monthly (preferred) or annual (acceptable)	N/A	PI	PI	N
3.1.2	Weather data	Hourly or daily	Provide weather data including ambient temperature, humidity, and direct/diffuse solar radiation at the nearest weather station.	PI	PI	Y
3.1.3	Indoor temperature (°C)	Hourly or daily	Indicate the indoor temperature in bedrooms and living rooms. .	PI	PI	Y
3.1.4	Indoor humidity	Hourly or daily	Indicate the indoor humidity in rooms frequently occupied or in the units.	PI	PI	N
3.1.5	Ventilation rate	Daily or daily mean value of typical days on weekdays/weekends in each season	Indicate the ventilation rate in rooms frequently occupied or in the units.	PI	PI	N
3.1.6	Indoor illumination	Daily or daily mean value of typical days on weekdays/weekends in each season	Indicate the indoor illumination in rooms frequently occupied	SI	SI	N
3.1.7	Index pollutants concentrations (e.g., formaldehyde, benzene, methylbenzene, xylene,CO2, CO, SO2, NO2, TVOC, PM10, pm2.5, NH3,O3,)	Daily or daily mean values of typical days on weekdays/weekends in each season	Indicate the TVOC concentration in rooms frequently occupied or in the units	SI	SI	N

3.2 Whole building characteristics

Table 2-18 Item definitions for whole building characteristics in Level C

Code	Item	Definition	SF	MF	Parameter Used for Simulation (Y/N/?)
3.2.1	Year built	Indicate the specific year built or select one of	PI	PI	Y

		the following categories: 1) Before 1920; 2) 1920 to 1945; 3) 1946 to 1959; 4) 1960 to 1969; 5) 1970 to 1979; 6) 1980 to 1989; 7) 1990 to 1999; 8) 2000 to 2009; 9) After 2009.			
3.2.2	Number of floors	Indicate the number of floors above ground, floors below ground and indicate what the function of underground floor is. Also indicate the floor to ceiling height.	SI	SI	Y
3.2.3	Conditioned, heated, semi-conditioned and unconditioned floor area	Indicate the floor area of floor space, as measured at the floor level within the external surfaces of walls enclosing the (1) conditioned, (2) heated, (3) semi-conditioned and (4) unconditioned space. It includes the attached space, such as basement, attic, if they are conditioned.	PI	PI	Y
3.2.4	Gross floor area for the whole building	Gross floor area is calculated including external walls of the entire house or building. The attached space should also be included, such as basement, attic, etc.	PI	PI	Y
3.2.5	Number of occupants	Number of occupants in each activity area and the value of design occupancy densities should be future calculated as the input parameter for simulation.	SI	SI	N
3.2.6	Gross floor area of each unit	Gross floor area is calculated including external walls. The attached space should also be included, such as basement, attic, etc; Also indicate the number of bedrooms, living rooms, bathrooms.	N/A	PI	Y
3.2.7	Type of building	Indicate the type of building: OR1) Single family; Condo3) Apartment; 4) Mobile home; 5) Studio; 6) Duplex; 7) Triplex; 8) Four-plex; 9) Condo; 10) Town home; 11) terraced house; 12) building complex; 13)Other	SI	SI	N
3.2.8	Other building activities	Select one or more of the following:1)Living room, 2)bedroom; 3)stairwell; 4)corridor, 5)basement, 6)garage, 7)attic, 8) vacant; 9)others For building complex, maybe including 1) food sales/food service, 2)shopping mall/retail, 3)warehouse/storage,4) other)	SI	SI	Y
3.2.9	Number of units		N/A	SI	Y
3.2.10	Gross floor area occupied by each	Provide floor area for all space/activity types listed in 3.2.8	SI	SI	Y

	activity				
3.2.11	Building geographical position	Provide the longitude, latitude and ASL.	SI	SI	N
3.2.12	Curtains/blinds	Provide the material and colour of curtains/blinds.	SI	SI	N
3.2.13	Planar graph	Provide an elevation drawing	SI	SI	Y
3.2.14	Ownership	Indicate whether the home or apartment is: 1) rented; 2) owned; 3) a condominium; 4) a cooperative 5) public housing.	SI	SI	N
3.2.15	Orientation	Provide the orientation for each façade.	PI	PI	Y

3.3 Building envelope and other components

Table 2-19 Item definitions for building envelope and other components in Level C

Code	Item	Definition	SF	MF	Parameter Used for Simulation (Y/N/?)
3.3.1	Building air tightness	Air change rate provided in times/hour.	SI	SI	Y
3.3.2	Wall material	Wall material (select one or more): 1) Brick, stone or stucco; 2) Concrete; 3) Concrete panels; 4) Siding or shingles; 5) Metal panels; 6) Curtain glass; 7) Other	PI	PI	Y
3.3.3	Ceiling material	Ceiling material (select one): 1) Brick 2) Concrete; 3) Concrete panels; 4) Stone; 5) Stucco; 6) Other	PI	PI	Y
3.3.4	Window material	Indicate the frame type, number of panes, glass type and percentage of operable windows. 1. Options for glass type: 1) Flat glass; 2) Insulating glass; 3) Insulating glass-AR; 4) Insulating glass-KR; 5) Low -e; 6) Other (OR LIST FROM BPD Low-e, Tinted, Reflective, Tinted/reflective, Other) 2. Select number of panes: 1) Single; 2) Double; 3) Triple; 4) Other 3. Select one frame type: 1) Aluminum, 2) Plastic steel; 3) Steel, 4) Wood; 5) Vinyl; 6) Other 4. Select the percentage of operable window: 1) Not operable; 2) less than 10%; 3) 10%-30%; 4) 30%-60%; 5) more than 60%.	PI	PI	Y
3.3.5	Floor material	Floor material (select one): 1) Brick; 2) Concrete;	PI	PI	Y

		3) Stone; 4) Stucco; 5) Other			
3.3.6	Roof material	Select one of the following for the roof material: 1) Built-up; 2) Slate or tile shingles; 3) Wood shingles/shakes/other wood; 4) Asphalt/fiberglass/other shingles; 5) Metal surfacing; 6) Plastic/rubber/synthetic sheeting; 7) Concrete; 8) Other	PI	PI	Y
3.3.7	Insulation material	Indicate the insulation materials for wall, ceiling, ground floor, basement wall, basement floor, attic and roof. • Wall insulation material: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Batt; 5) Fiberboard sheathing; 6) Rockwool; 7) Other; 8) No insulation • Roof insulation material: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Batt; 5) Fiberglass; 6) Rockwool; 7) Others; 8) No insulation • Floor insulation material: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Other; 5) No insulationOptions for attic (select one): 1) Fiberglass; 2) Rockwool; 3) Insulsafe; 4) Recycled cotton; 5) ISOCY; 6) Icynene; 7) Unknown insulation; 8) Not insulated; 9) Other	PI	PI	Y
3.3.8	Material thickness	Provide the thickness of materials listed in 3.3.2 through 3.3.7.	SI	SI	Y
3.3.9	Area of the components	Provide the area of the exterior walls, roof, and windows	SI	SI	Y
3.3.10	Shading system	• Shading system (select one or more): 1) Exterior shading; 2) Interior shading; 3) Within glazing system/façade system • Exterior shading: 1) Awnings, 3) Solar screens; 4) Solar film; 5) Blinds; 6) Other; 7) None • Interior shading: 1) blinds; 2) Shading cloths; 3) Other; 4) None	SI	SI	Y
3.3.11	U-value	Provided for all of the building envelope materials provided in 3.3.2 through 3.3.7 using the units: w/(m2*k).	PI	PI	Y
3.3.12	Comprehensive shading coefficient of the windows	This coefficient considers the shading effects of both windows and exterior shading. It equals the shading coefficient of windows multiplied by the shading coefficient of exterior shading. This can also be solar factor.	SI	SI	N

3.3.13	Window to wall ratio	Indicate the specific ratio or Select one of the following for each façade: 1) 25 % or less; 2) 25%-35%; 3) 35%-45%; 4) more than 45%. This should exclude the roof area.	PI	PI	Y
3.3.14	Shape factor	The ratio of surface area that is exposed to the outside area to the enclosed volume, and the surface area does not include the floor area, door area and internal wall area of the stairwells without district space heating.	SI	SI	Y
3.3.15	Solar heat gain coefficient	Provide the solar heat gain coefficient of glazing	SI	SI	Y
3.3.16	Curtains/blinds	Provide the material and colour of curtains/blinds.	SI*	SI*	Y

3.4 **Building services and energy systems**

Building service and energy systems here refer to the building technical systems, including space heating, air conditioning, ventilation, lighting, domestic hot water, cooking, domestic appliances and others, such as elevators and security monitors. Usually, most of the residential buildings use decentralized systems, but some residential buildings use centralized systems, and household centralize AC system is classified into central system. The following table defines the information that should be recorded for each building technical systems and appliances.

Table 2-20 Item definitions for building services and energy systems in Level C

Code	Category	Item	Parameters	SF	MF	Parameter Used for Simulation (Y/N/?)
3.4.1	Air conditioning - centralized	Parameters used for the overall system	Heating/Cooling Indoor Design Temperature: The indoor temperature to be used to size airflow for the system type. Heating/Cooling Indoor Design Temperature should be greater/less than or equal to the Thermostat Cooling Set Point	PI	PI	Y
			Ventilation Rate Per Occupant: The minimum allowable flow rate of outside ventilation air per person (based on peak occupancy).	SI	SI	Y
			Other overall performance	SI	SI	N
		Heat source(s)	Type(s) of heating sources (select one or more): 1) Boilers; 2) Heat pumps; 3) Other	PI	PI	Y
			Number of each type of component	PI	PI	Y

			Energy type	PI	PI	Y
			Power rating (kw)	PI	PI	Y
			Heat capacity supplied by each type of the heat sources	PI	PI	Y
			Control method: 1) Programmable thermostat; 2) Manual thermostat; 3) Digital thermostat; 4) Timer; 5) Part of EMCS; 6) Other	SI	SI	N
			Heat source efficiency (COP)	PI	PI	Y
			Energy efficiency label or not	SI	SI	N
		Cooling source(s)	Type(s) of cooling sources (select one or more): 1) Heat pumps; 2) Central chillers inside the building; 3) Evaporative or swamp coolers; 4) Condenser; 5) Natural heat sink; 6) Other	PI	PI	Y
			Number of each type of component	PI	PI	Y
			Energy type	PI	PI	Y
			Cooling source efficiency (EER)	PI	PI	Y
			Power rating (kw)	PI	PI	Y
			Cooling capacity supplied by each type of cooling sources	PI	PI	Y
			Control method: 1) Programmable thermostat; 2) Manual thermostat; 3) Digital thermostat; 4) Timer; 5) Part of EMCS; 6) Other	SI	SI	N
			Energy efficiency label or not	SI	SI	N
		3) District space heating/ cooling	Number of pumps	PI	PI	Y
			Water volume	PI	PI	Y
			Head for pumps	PI	PI	Y
			Total power of pumps	PI	PI	Y
			Heating/cooling capacity	PI	PI	Y
			Efficiency of the heat pipe network (please indicate length of pipes and thickness of insulation if possible)	SI	SI	N
		4) Chilled water pump	Number of appliances	PI	PI	Y
			Water volume	PI	PI	Y
			head for pumps	PI	PI	Y
			Total power of pumps	PI	PI	Y
			Pump efficiency (standard, high, premium)	SI	SI	Y
			Energy efficiency label or not	SI	SI	N

5) Cooling water pump: fixed-frequency / frequency conversion	Number of appliances	PI	PI	Y
	Water volume	PI	PI	Y
	Head for pumps	PI	PI	Y
	Total power of pumps	PI	PI	Y
	Fan/pump efficiency (standard, high, premium)	SI	SI	Y
	Energy efficiency label or not	SI	SI	N
6) AHU	Number of appliances	PI	PI	Y
	Total power	PI	PI	Y
	Fan efficiency (standard, high, premium)	SI	SI	Y
	Energy efficiency label or not	SI	SI	N
7) FCU: Two-pipe fan coil; Three pipe fan coil; Four pipe fan coil	Number of appliances	PI	PI	Y
	Minimum design airflow: Used to set a "floor" (i.e., minimum) for the design airflow supplied to each space. Minimum design airflow pertains to airflow at design (maximum) conditions.	SI	SI	Y
	Fan efficiency (standard, high, premium)	SI	SI	Y
	Total power	PI	PI	Y
	Energy efficiency label or not	SI	SI	N
8) Radiative unit	Type of the units: 1) Radiators; 2) Floor radiative system; 3) Wall radiative systems; 4) Ceiling radiative systems; 5) Other	PI	PI	N
9) Cooling Tower	Number of appliances	PI	PI	Y
	Volume of cooling water (m3/h), air volume (m3/h)	SI	SI	Y
	Total power	PI	PI	Y
	Energy efficiency label or not	SI	SI	N
10) Pumps of cooling storage systems	Number of appliances	PI	PI	Y
	Head for pumps	PI	PI	Y
	Total power	PI	PI	Y
	Pump efficiency (standard, high, premium)	SI	SI	Y
	Energy efficiency label or not	SI	SI	N
11) Heat exchanger	Number of appliances	PI	PI	Y

			Area of heat exchange for heat exchangers	SI	S	N
			Energy efficiency label or not	SI	SI	N
		12) Economizer	Number of appliances	PI	PI	Y
			High limit temperature: This specifies the maximum allowable outside air temperature for which the economizer is enabled.	SI	SI	Y
			Energy efficiency label or not	SI	SI	N
		13) Other	Other	SI	SI	N
3.4.2	Space heating - Centralized	1) Heat source(s)	Type(s) of heating sources (select one or more): 1) District steam hot water; 2) Boilers inside the building; 3) Other)	PI	PI	Y
			Number of each type of component	PI	PI	Y
			Energy type	PI	PI	Y
			Power rating (kw)	PI	PI	Y
			Heat capacity supplied by each type of the heat sources	PI	PI	Y
			Control method: 1) Programmable thermostat; 2) Manual thermostat; 3) Digital thermostat; 4) Timer; 5) Part of EMCS; 6) Other	SI	SI	N
			Energy efficiency of the boiler (COP)	PI	PI	Y
			Energy efficiency label or not	SI	SI	N
		2) Hot water pumps	Number of appliances	PI	PI	Y
			Water volume	PI	PI	Y
			head for pumps	PI	PI	Y
			Total power of pumps	PI	PI	Y
			Pump efficiency (standard, high, premium)	SI	SI	Y
			Energy efficiency label or not	SI	SI	N
		3) Radiative unit	Type of the units: 1) Radiators; 2) Floor radiative system; 3) Wall radiative systems; 4) Ceiling radiative systems; 5) Other	PI	PI	N
		4) Heat exchanger	Number of appliances	PI	PI	Y
			Area of heat exchange for heat exchangers	SI	SI	N
			Energy efficiency label or not	SI	SI	N
		5)	Number of appliances	PI	PI	Y

		Economizer	High limit temperature: This specifies the maximum allowable outside air temperature for which the economizer is enabled.	SI	SI	Y
			Energy efficiency label or not	SI	SI	N
3.4.3	Space heating - decentralized	Type of decentralized system (Select one or more: 1) Individual space heaters; 2) Furnaces; 3) Other)	Number of each type of heater	PI	PI	N
			Fuel type	PI	PI	Y
			Total power (w)	PI	PI	Y
			Power rating of each type(w)	PI	PI	Y
			Heat/cooling capacity (w)	PI	PI	Y
			Energy efficiency label or not	SI	SI	N
			Other performance	SI	SI	N
3.4.4	Air conditioning - decentralized		Type of local air conditioner (Select one or more: 1); 1) Individual room A/C; 2) with humidifiers or dehumidifiers;3) Other)	PI	PI	Y
			Number of each type of air conditioner	PI	PI	N
			Fuel type	PI	PI	Y
			Power rating of each type(w)	PI	PI	Y
			Heat/cooling capacity (w)	PI	PI	Y
			Energy efficiency label or not	SI	SI	N
			Other performance (humidification/dehumidification capacity)	SI	SI	N
3.4.5	Ventilation - centralized		Type of centralized system (Select one or more: 1) Mechanical exhaust; 2) Plenum system; 3) Heat exchanger(if used with separate ventilation systems);; 4) Local humidifier and dehumidifier (if used with separate ventilation systems);5) Other)	PI	PI	N
			Number of each type	SI	SI	N
			Power intensity of each building activity area(w)	PI	PI	Y
			Total power	PI	PI	N
			Pump efficiency (standard, high, premium)	PI	PI	Y

		Locations served (select one or more): 1) Garage; 2) Basement; 3) Offices; 4) Restrooms; 6) Corridors; 7) Lobby; 8) Other	PI	PI	Y
3.4.6	Ventilation - decentralized	Number of fans	PI	PI	N
		Total power	PI	PI	N
		Power intensity of each building activity area (w)	PI	PI	Y
		Pump efficiency (standard, high, premium)	SI	SI	N
		Locations served (select one or more): 1) Garage; 2) Basement; 3) Offices; 4) Restrooms; 6) Corridors; 7) Lobby; 8) Other	SI	SI	N
3.4.7	Lighting	Types of lighting (Select one or more: 1) Incandescent bulbs; 2) Fluorescent bulbs; 3) Compact fluorescent bulbs; 4) LEDs; 5) Other) including indoor and outdoor lighting	PI	PI	N
		Number of lighting appliances	PI	PI	N
		Control method (photo/occupancy/scheduling) (Control Types from BPD: Daylight dimming, Occupancy sensors, Manual dimming, Bi-level control; Manual; Part of EMCS; Other)	SI	SI	N
		Power density for each activity area	PI	PI	Y
		Total power (w)	PI	PI	N
		Energy efficiency label or not	SI	SI	N
3.4.8	Domestic hot water – centralized	Type of centralized hot water system (Select one: 1) District hot water; 2) Central hot water in the building; 3) Other)	PI	PI	N
		Fuel type	PI	PI	Y
		Total power (w)	PI	PI	Y
		Heat capacity of the building (w)	PI	PI	Y
		Control method: 1) Programmable thermostat; 2) Manual thermostat; 3) Digital thermostat; 4) Timer; 5) Part of EMCS; 6) Other	SI	SI	N
3.4.9	Domestic hot water – decentralized	Type of decentralized hot water system:1)Local water heaters;2)others	PI	PI	N
		Fuel types	PI	PI	Y

			Power rating of each type	PI	PI	Y
			Number of each type	PI	PI	N
			Tank capacity	PI	PI	Y
			Energy efficiency	SI	SI	N
			Control method (Select one) 1) Programmable thermostat; 2) Manual thermostat; 3) Other	SI	SI	N
			Temperature of supply water	PI	PI	Y
			Energy efficiency label or not	SI	SI	N
3.4.10	Cooking		Type(s) of appliances used for cooking (Select one or more: 1) Oven; 2) Cooktop; 3) Microwave; 4) Coffee maker; 5) Toaster oven; 5) Refrigerator; 6) Separate freezer; 7) Dishwasher; 7) Toaster; 8) Other)	PI	PI	N
			Number of appliances	SI	SI	N
			Fuel type	PI	PI	Y
			Total power (w)	PI	PI	N
			Power intensity	PI	PI	Y
			Energy efficiency label or not	SI	SI	N
3.4.11	Domestic appliances		Type(s) of appliances · Entertainment – Select or more: 1) TV; 2) VCR/DVD; 3) Stereo system; 4) Computer & related electronics; 5) Telephone/fax; 6) Printer/scanner; 7) Portable, rechargeable devices; 8) Other · Housework and health: 1) Clothes washer; 2) Clothes dryer; 3) Iron; 4) Vacuum; 5) Dehumidifier /humidifier; 6) Other	PI	PI	N
			Number of each type	SI	SI	N
			Total power (w)	PI	PI	N
			Power intensity (kw/m2)	PI	PI	Y
			Energy efficient label or not	SI	SI	N
3.4.12	Other	Types of other equipment used in the building (Select one	Number of appliances	SI	SI	N
			Fuel type	PI	PI	Y
			Total power (w)	PI	PI	N
			Power intensity of each building activity area(kw/m2)	PI	PI	Y

		or more: 1) Elevator; 2) Security monitors; 3) Other)	Energy efficient label or not	SI	SI	N

3.5 Building operation and occupant behavior

As for the description of building operation and occupant behaviour, there are five ways to describe their characteristics and rules, with several subschemas to provide a more specific description.

(1) Schedule: The change of an object's status depends on a certain schedule.
(2) Set point: The occupant changes the status of an object based on a set point.
(3) Control: The occupant changes the status of an object based on a control objective.
(4) Space: The occupant operates an object in either the full space or part space.
(5) Random: The change of objects' status has no certain discipline and runs randomly.

A. Subschema definitions

NOTE: When the definitions include an X, it is recommended to collect data on the specific times, temperature, percentages, level, etc.

Table 2-21 subschema definitions in Level C

Item	Mode	Code	Definition	Parameter Used for Simulation (Y/N/?)
Schedule	Subschema 1: Time mode (for appliances with long daily operation periods)	1.1	Full time or part time (when occupied) in each month or season.	N
		1.2	Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	Y
	Subschema 2: Event mode (for the appliances with short or infrequent operation periods)	2.1	Number of times per day/week/month and minutes per time for use.	N
		2.2	Starting time and ending time of this event	Y
	Subschema 3: Load mode	3.1	At which time periods for full load; at which time periods for partial load.	N

		3.2	Fraction of the nominal lighting power (value between 0 and 1) for each hour during business hours, break time, non-business hours (overtime and weekends) and holidays.	Y
		3.3	Fraction of the nominal appliance power (value between 0 and 1) for each hour during business hours, break time, non-business hours (overtime and weekends) and holidays.	Y
	Subschema 4: Portion mode	4.1	Percentage of the objects (fan, shades, lighting, window, etc.) that are opened or used.	Y
		4.2	Fraction of the nominal occupancy (value between 0 and 1) for each hour of the day for offices and meeting rooms.	Y
		4.3	Percentage of shades closed/window opening width for each hour of the day when the building is occupied and unoccupied.	Y
	Subschema 5: Temperature setback mode	5	At what time period when the indoor temperature is setback	N
Set point	Subschema 6: Single point mode	6	Always set at a certain point (x℃) for the indoor temperature or supply temperature for domestic hot water, chilled water set point, heating/cooling coil discharge temperature, etc. (If possible, please indicate the specific indoor temperature setback points when space is unoccupied.)	Y
	Subschema 7: Range mode	7	Usually set the indoor temperature or supply temperature of domestic hot water, chilled water set point, heating/cooling coil discharge temperature, etc. in the range of x(minimum) – y(maximum) (If possible, please indicate the specific temperature setback ranges when not occupied.).	Y
	Subschema 8: Load mode	8	Reset the supply cold/hot air/water temperature based on the actual load so that the valve of the worst-case coil is fully open (For hot water set point, chilled water set point)	Y
	Subschema 9: Outdoor temperature mode	9.1	When the outdoor temperature is higher than x℃, reset the supply cold/hot air/water temperature, and supply temperature of domestic hot water at a certain point (usually a minimum point) or in the range of x℃-x℃. (For chilled water set point, cold/hot Deck Reset temperatures (cold/heating deck leaving temperature))	Y

		9.2	When the outdoor temperature lower than x℃, reset the cold/hot supply air/water temperature, and supply temperature of domestic hot water at a certain point (usually a maximum point) or in the range of x℃-x℃. (For chilled water set point, cold/hot Deck Reset temperatures (cold/heating deck leaving temperature))	Y
	Subschema 10: Flux mode for hot water	10	A certain amount (x litres per person per day) of water use per person as if it is a set point (This subschema could be used for simulation or calculation).	Y
Control	Subschema 11: indoor Temperature mode	11.1	When the indoor temperature/humidity higher than x℃, open it.	N
		11.2	When the indoor temperature/humidity lower than x℃, open it.	N
	Subschema 12: Air quality mode	12.1	When there is a certain level of CO_2 or CO, open it.	N
		12.2	When there is a certain level of CO_2 or CO, close it.	N
	Subschema 13: Frequency mode	13.1	Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	Y
		13.2	Gear limit (For example: high/low speed only)	N
	Subschema 14: Illumination mode	14	When the illumination outside is < x lux, open it.	N
	Subschema 15: Personnel mode	15	When there are the occupants, open or use it.	N
	Subschema 16: Solar irradiation mode	16	When solar irradiation is strong (such as > xJ/(cm2*min)), close it.	N
	Subschema 17: On/off mode	17.1	When not in use, turned off (appliances and lighting).	N
		17.2	When not in use, in standby mode (appliances and lighting).	N
		17.3	When not in use, left on (appliances and lighting).	N
	Subschema 18: Temperature difference + # of machines running mode	18	When temperature difference is higher than x℃, open one or more machines, etc.	N

	Subschema 19: Standby mode	19	The loop is active (i.e., pumps on) whenever any one of the systems served by the loop is running (i.e., fans on). Note that in this mode even if all of the thermostats in all of the zones served by the loop are satisfied (i.e., no load), the loop will be active (i.e., pumps running). (CHW LOOP PUMP CONTROL/hot water system control)	Y
	Subschema 20: Scheduled mode	20	The loop activates according to a user-defined schedule. The default schedule matches the fan schedule, which initially makes this option functionally identical to "Standby." (CHW LOOP PUMP CONTROL/hot water system control)	Y
	Subschema 21: Demand mode	21	The loop is active only when a coil load (i.e., thermostat demand) actually exists. This is the most energy-efficient mode of operation. For example, if an attached system is running, pumps will not activate until there is actually a heating load. (CHW LOOP PUMP CONTROL/hot water system control)	Y
	Subschema 22: Order control of different appliance use mode	22	1. Open the window first, and then use the air conditioner. 2. Use electrical fan, then use the air conditioner.	N
	Subschema 23: Operator mode	23.1	Object controlled by occupants.	N
		23.2	Object controlled by building managers.	N
Space	Subschema 24: Full space mode	24	In the full space.	N
	Subschema 25: Part space mode	25	In part of the space. Indicate the percentage of area or which areas in each zone where the objects are used.	Y
Random	Subschema 26: Random mode	26	The change of object's status has no certain discipline, and runs randomly.	N

B. Building system operation modes, schedule, set point and control

In this part, the above subschemas are chosen to describe the operation schedule, set points and control of technical building systems, based on the actual possible conditions.

B: Definitions for occupancy, building service and energy systems, window opening, curtain and blinding.

Table 2-22 Item definition of occupancy schedule in Level C

Occupancy Schedule

Item	Potential Subschema	SF/MF
Schedule	Subschema 1.2: Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	SI
	Subschema 4.2 Fraction of the nominal occupancy (value between 0 and 1) for each hour of the day for offices and meeting rooms.	PI
	Subschema 26 The change of object's status has no certain discipline, and runs randomly.	SI
Set Point	N/A	
Control	N/A	
Space	Subschema 24: occupied in the full space.	SI
	Subschema 25: occupied in part of the space. Indicate the percentage of area or which areas in each zone are occupied	SI

Table 2-23 Item definition of operation of air conditioning system (centralized) in Level C

Air Conditioning – Centralized

Object	Item	Potential Subschema	SF/MF
Indoor temperature	Schedule	Subschema 5: At what time period when the indoor temperature is setback	SI
	Set Point	Subschema 6 Always set at a certain point (x℃) for the indoor temperature (If possible, please indicate the specific indoor temperature setback points when space is unoccupied.)	PI
		Subschema 7 Usually set the indoor temperature in the range of x(minimum) – y(maximum) (If possible, please indicate the specific temperature setback ranges when not occupied.).	PI
		Subschema 9.1 When the outdoor temperature is higher than x℃, reset indoor temperature at a certain point (usually a minimum point) or in the range of x℃-x℃.	SI
		Subschema 9.2 When the outdoor temperature lower than x℃, reset the indoor temperature at a certain point (usually a maximum point) or in the range of x℃-x℃.	SI
	Control	N/A	
	Space	Subschema 24, in full space	PI
		Subschema 25set in part of the space. Indicate the percentage of area or which areas in each zone where the specific temperature is set.	PI
Heat sources	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI

		Subschema 1.2: Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the heat sources that are used.	PI
	Set Point	Subschema 6 (For supply/return temperature of hot water): Always set at a certain point (x℃) for the hot water , etc. (If possible, please indicate the specific indoor temperature setback points when space is unoccupied.)	PI
		Subschema 7 (For supply/return temperature of hot water): Usually set the supply temperature of hot water in the range of x(minimum) – y(maximum) (If possible, please indicate the specific temperature setback ranges when not occupied.).	PI
		Subschema 9.1 When the outdoor temperature is higher than x℃, reset the supply hot water temperature, and supply temperature of domestic hot water at a certain point (usually a minimum point) or in the range of x℃-x℃ .	SI
		Subschema 9.2 When the outdoor temperature lower than x℃, reset the supply hot water temperature at a certain point (usually a maximum point) or in the range of x℃-x℃.	SI
	Control	Subschema 13.1 Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 18 When temperature difference is higher than x℃, open one or more machines, etc.	SI
		Subschema 23.2 Object controlled by building managers.	SI
	Space	N/A	
Cooling sources	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the heat sources that are used.	PI
	Set Point	Subschema 6 (For supply/return temperature of chilled water): Always set at a certain point (x℃) for the chilled water/hot water , etc. (If possible, please indicate the specific indoor temperature setback points when space is unoccupied.)	PI
		Subschema 7 (For supply/return temperature of chilled water): Usually set the supply temperature of chilled water in the range of x(minimum) – y(maximum) (If possible, please indicate the specific temperature setback ranges when not occupied.).	PI

		Subschema 9.1 (For supply/return temperature of chilled water): When the outdoor temperature is higher than x℃, reset the supply chilled water temperature, and supply temperature of domestic hot water at a certain point (usually a minimum point) or in the range of x℃-x℃ .	SI
		Subschema 9.2 (For supply/return temperature of chilled water):When the outdoor temperature lower than x℃, reset the supply chilled water temperature at a certain point (usually a maximum point) or in the range of x℃-x℃.	SI
	Control	Subschema 13.1 Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 18 When temperature difference is higher than x℃, open one or more machines, etc.	SI
		Subschema 23.2 Object controlled by building managers.	SI
	Space	N/A	
District space heating/cooling	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
	Set Point	Subschema 6 (For supply/return temperature of hot/cold water): Always set at a certain point (x℃) for the hot/chilled water , etc. (If possible, please indicate the specific indoor temperature setback points when space is unoccupied.)	PI
		Subschema 7 (For supply/return temperature of hot/cold water): Usually set the supply temperature of hot/chilled water in the range of x(minimum) – y(maximum) (If possible, please indicate the specific temperature setback ranges when not occupied.).	PI
		Subschema 9.1 For supply/return temperature of hot/cold water):When the outdoor temperature is higher than x℃, reset the supply hot/chilled water temperature, and supply temperature of domestic hot water at a certain point (usually a minimum point) or in the range of x℃-x℃ .	SI
		Subschema 9.2 For supply/return temperature of hot/cold water): When the outdoor temperature lower than x℃, reset the supply hot/chilled water temperature at a certain point (usually a maximum point) or in the range of x℃-x℃.	SI
	Control	Subschema 13.1 Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 23.2 Object controlled by building managers	SI

	Space	Subschema 24: supplied in the full space.	SI
		Subschema 25: supplied in part of the space. Indicate the percentage of area or which areas in each zone supplied.	SI
Chilled water pump	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the pumps that are used.	PI
	Control	Subschema 13.1:Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 13.2:Gear limit (For example: high/low speed only)	PI
		Subschema 18: When temperature difference is higher than x℃, open one or more machines, etc.	SI
		Subschema19: The loop is active (i.e., pumps on) whenever any one of the systems served by the loop is running (i.e., fans on). Note that in this mode even if all of the thermostats in all of the zones served by the loop are satisfied (i.e., no load), the loop will be active (i.e., pumps running). (CHW LOOP PUMP CONTROL/hot water system control)	SI
		Subschema 20: The loop activates according to a user-defined schedule. The default schedule matches the fan schedule, which initially makes this option functionally identical to "Standby." (CHW LOOP PUMP CONTROL/hot water system control)	SI
		Subschema 21:The loop is active only when a coil load (i.e., thermostat demand) actually exists. This is the most energy-efficient mode of operation. For example, if an attached system is running, pumps will not activate until there is actually a heating load. (CHW LOOP PUMP CONTROL/hot water system control)	SI
		Subschema 23.2 Object controlled by building managers.	SI
	Space	N/A	
Cooling water pump	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the pumps that are used.	PI

	Control	Subschema 13.1:Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 13.2:Gear limit (For example: high/low speed only)	PI
		Subschema 18: When temperature difference is higher than x℃, open one or more machines, etc.	SI
		Subschema 19: The loop is active (i.e., pumps on) whenever any one of the systems served by the loop is running (i.e., fans on). Note that in this mode even if all of the thermostats in all of the zones served by the loop are satisfied (i.e., no load), the loop will be active (i.e., pumps running). (CHW LOOP PUMP CONTROL/hot water system control)	SI
		Subschema 20: The loop activates according to a user-defined schedule. The default schedule matches the fan schedule, which initially makes this option functionally identical to "Standby." (CHW LOOP PUMP CONTROL/hot water system control)	SI
		Subschema 21:The loop is active only when a coil load (i.e., thermostat demand) actually exists. This is the most energy-efficient mode of operation. For example, if an attached system is running, pumps will not activate until there is actually a heating load. (CHW LOOP PUMP CONTROL/hot water system control)	SI
		Subschema 23.2 Object controlled by building managers.	SI
	Space	N/A	
AHU fan	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the fans that are used.	PI
	Set Point	Subschema 6: Usually set the supply cold/hot air temperature at a specific point (If possible, please indicate the specific temperature setback point when not occupied.).	PI
		Subschema 7: Usually set the supply cold/hot air temperature in the range of x℃-x℃ (If possible, please indicate the specific temperature setback ranges when not occupied.).	PI
		Subschema 8:Reset the supply cold/hot air temperature based on the actual load so that the valve of the worst-case coil is fully open.	SI

		Subschema 9.1: When the outdoor temperature is higher than x℃, reset the supply cold/hot air at a certain point (usually a minimum point) or in the range of x℃-x℃ . (For cold/hot Deck Reset temperatures (cold/heating deck leaving temperature))	SI
		Subschema 9.2: When the outdoor temperature lower than x℃, reset the cold/hot supply air temperature at a certain point (usually a maximum point) or in the range of x℃-x℃. (For cold/hot Deck Reset temperatures (cold/heating deck leaving temperature))	SI
	Control	Subschema 13.1:Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 13.2:Gear limit (For example: high/low speed only)	PI
		Subschema 23.1 Object controlled by occupants.	SI
		Subschema 23.2 Object controlled by building managers.	SI
	Space	Subschema 24: supplied in the full space.	SI
		Subschema 25: supplied in part of the space. Indicate the percentage of area or which areas in each zone supplied.	SI
FCU fan	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the fans that are opened or used.	PI
	Set Point	Subschema 6: Usually set the supply cold/hot air temperature at a specific point (If possible, please indicate the specific temperature setback points when not occupied.).	PI
		Subschema 7: Usually set the supply cold/hot air temperature in the range of x℃-x℃ (If possible, please indicate the specific temperature setback ranges when not occupied.).	PI
		Subschema 8:Reset the supply cold/hot air temperature based on the actual load so that the valve of the worst-case coil is fully open.	SI
		Subschema 9.1: When the outdoor temperature is higher than x℃, reset the supply cold/hot air at a certain point (usually a minimum point) or in the range of x℃-x℃ . (For cold/hot Deck Reset temperatures (cold/heating deck leaving temperature))	SI

		Subschema 9.2: When the outdoor temperature lower than x℃, reset the cold/hot supply air temperature at a certain point (usually a maximum point) or in the range of x℃-x℃. (Forcold/hot Deck Reset temperatures (cold/heating deck leaving temperature))	SI
	Control	Subschema 13.1:Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 13.2:Gear limit (For example: high/low speed only)	PI
		Subschema 23.1 Object controlled by occupants.	SI
		Subschema 23.2 Object controlled by building managers.	SI
	Space	Subschema 24: supplied in the full space.	SI
		Subschema 25: supplied in part of the space. Indicate the percentage of area or which areas in each zone supplied.	SI
Cooling tower	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the cooling towers that are opened or used.	PI
	Control	Subschema 18 When temperature difference is higher than x℃, open one or more machines, etc.	SI
		Subschema 23.2 Object controlled by building managers.	SI
	Space	N/A	
Pumps for cooling storage systems	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the pumps that are opened or used.	SI
	Set Point	N/A	
	Control	Subschema 13.1:Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 13.2:Gear limit (For example: high/low speed only)	PI
		Subschema 23.1 Object controlled by occupants.	SI
	Space	N/A	

Heat exchanger	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the heat exchangers that are opened or used.	SI
	Control	Subschema 13.1:Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 13.2:Gear limit (For example: high/low speed only)	PI
		Subschema 23.1 Object controlled by occupants.	SI
	Space	N/A	
Radiator/ Floor/wall /ceiling radiative systems	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI PI
		Subschema 4.1 Percentage of the radiative system that is opened or used.	SI
	Set Point	Subschema 6: Usually set the supply cold/hot air temperature at a specific point (If possible, please indicate the specific temperature setback point when not occupied.).	PI
		Subschema 7: Usually set the supply cold/hot air temperature in the range of x℃-x℃ (If possible, please indicate the specific temperature setback ranges when not occupied.).	PI
		Subschema 9.1: When the outdoor temperature is higher than x℃, reset the supply cold/hot air at a certain point (usually a minimum point) or in the range of x℃-x℃ . (For cold/hot Deck Reset temperatures (cold/heating deck leaving temperature))	SI
		Subschema 9.2: When the outdoor temperature lower than x℃, reset the cold/hot supply air temperature at a certain point (usually a maximum point) or in the range of x℃-x℃. (For cold/hot Deck Reset temperatures (cold/heating deck leaving temperature))	SI
	Control	Subschema 23.1 (For personal space) Object controlled by occupants.	SI
	Space	Subschema 24: supplied in the full space.	PI
		Subschema 25: supplied in part of the space. Indicate the percentage of area or which areas in each zone supplied.	PI
Economizer	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI

		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the economizers that is opened or used.	PI
	Control	Subschema 23.2 Object controlled by building managers	SI
	Space	N/A	

Table 2-24 Item definition of operation of space heating system (centralized) in Level C

Space Heating – Centralized

Object	Item	Potential Subschema	SF/MF
indoor temperature	Schedule	Subschema 5: At what time period when the indoor temperature is setback	SI
	Set Point	Subschema 6 Always set at a certain point (x℃) for the indoor temperature (If possible, please indicate the specific indoor temperature setback points when space is unoccupied.)	PI
		Subschema 7 Usually set the indoor temperature in the range of x(minimum) – y(maximum) (If possible, please indicate the specific temperature setback ranges when not occupied.).	PI
		Subschema 9.1 When the outdoor temperature is higher than x℃, reset indoor temperature at a certain point (usually a minimum point) or in the range of x℃-x℃.	SI
		Subschema 9.2 When the outdoor temperature lower than x℃, reset the indoor temperature at a certain point (usually a maximum point) or in the range of x℃-x℃.	SI
	Control	N/A	
	Space	Subschema 24, in full space	PI
		Subschema 25set in part of the space. Indicate the percentage of area or which areas in each zone where the specific temperature is set.	PI
Heat sources	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2: Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the heat sources that are used.	PI
	Set Point	Subschema 6 (For supply/return temperature of hot water): Always set at a certain point (x℃) for the hot water , etc. (If possible, please indicate the specific indoor temperature setback points when space is unoccupied.)	PI

		Subschema 7 (For supply/return temperature of hot water): Usually set the supply temperature of hot water in the range of x(minimum) – y(maximum) (If possible, please indicate the specific temperature setback ranges when not occupied.).	PI
		Subschema 9.1 When the outdoor temperature is higher than x℃, reset the supply hot water temperature, and supply temperature of domestic hot water at a certain point (usually a minimum point) or in the range of x℃-x℃ .	SI
		Subschema 9.2 When the outdoor temperature lower than x℃, reset the supply hot water temperature at a certain point (usually a maximum point) or in the range of x℃-x℃.	SI
	Control	Subschema 13.1 Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 18 When temperature difference is higher than x℃, open one or more machines, etc.	SI
		Subschema 23.2 Object controlled by building managers.	SI
	Space	N/A	
hot water pump	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the pumps that are used.	PI
	Control	Subschema 13.1:Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 13.2:Gear limit (For example: high/low speed only)	PI
		Subschema 18: When temperature difference is higher than x℃, open one or more machines, etc.	SI
		Subschema19: The loop is active (i.e., pumps on) whenever any one of the systems served by the loop is running (i.e., fans on). Note that in this mode even if all of the thermostats in all of the zones served by the loop are satisfied (i.e., no load), the loop will be active (i.e., pumps running). (CHW LOOP PUMP CONTROL/hot water system control)	SI
		Subschema 20: The loop activates according to a user-defined schedule. The default schedule matches the fan schedule, which initially makes this option functionally identical to “Standby.” (CHW LOOP PUMP CONTROL/hot water system control)	SI

		Subschema 21:The loop is active only when a coil load (i.e., thermostat demand) actually exists. This is the most energy-efficient mode of operation. For example, if an attached system is running, pumps will not activate until there is actually a heating load. (CHW LOOP PUMP CONTROL/hot water system control)	SI
		Subschema 23.2 Object controlled by building managers.	SI
	Space	N/A	
Heat exchanger	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the heat exchangers that are opened or used.	PI
	Control	Subschema 13.1:Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 13.2:Gear limit (For example: high/low speed only)	PI
		Subschema 23.1 Object controlled by occupants.	SI
	Space	N/A	
Radiator/ (Floor/wall/ceiling radiative systems)	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the radiative system that is opened or used.	SI
	Set Point	Subschema 6: Usually set the supply hot air temperature at a specific point (If possible, please indicate the specific temperature setback point when not occupied.).	PI
		Subschema 7: Usually set the supply hot air temperature in the range of x℃-x℃ (If possible, please indicate the specific temperature setback ranges when not occupied.).	PI
		Subschema 9.2: When the outdoor temperature lower than x℃, reset the hot supply air temperature at a certain point (usually a maximum point) or in the range of x℃-x℃. (For hot Deck Reset temperatures (heating deck leaving temperature))	SI
	Control	Subschema 23.1 (For personal space) Object controlled by occupants.	SI

	Space	Subschema 24: supplied in the full space.	PI
		Subschema 25: supplied in part of the space. Indicate the percentage of area or which areas in each zone supplied.	PI
Economizer	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the economizers that is opened or used.	PI
	Control	Subschema 23.2 Object controlled by building managers	SI
	Space	N/A	

Table 2-25 Item definition of operation of space heating system (decentralized) in Level C

Space Heating – Decentralized

Item	Potential Subschema	SF/MF
Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
	Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
	Subschema 4.1 Percentage of the space heaters that are used.	PI
Set Point	Subschema 6 Always set at a certain point (x℃) for the indoor temperature (If possible, please indicate the specific indoor temperature setback points when space is unoccupied.)	PI
	Subschema 7 Usually set the indoor temperature in the range of x(minimum) – y(maximum) (If possible, please indicate the specific temperature setback ranges when not occupied.).	PI
	Subschema 9.1 When the outdoor temperature is higher than x℃, reset indoor temperature at a certain point (usually a minimum point) or in the range of x℃-x℃ .	SI
	Subschema 9.2 When the outdoor temperature lower than x℃, reset the indoor temperature at a certain point (usually a maximum point) or in the range of x℃-x℃.	SI
Control	Subschema 13.2:Gear limit (For example: high/low power only)	PI
Space	Subschema 24: supplied in the full space.	PI
	Subschema 25: supplied in part of the space. Indicate the percentage of area or which areas in each zone supplied.	PI

Table 2-26 Item definition of operation of air conditioning system (decentralized) in Level C

Air Conditioning – Decentralized

Item	Potential Subschema	SF/MF
Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
	Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
	Subschema 4.1 Percentage of AC that are used.	PI
Set Point	Subschema 6 Always set at a certain point (x℃) for the indoor temperature (If possible, please indicate the specific indoor temperature setback points when space is unoccupied.)	PI
	Subschema 7 Usually set the indoor temperature in the range of x(minimum) – y(maximum) (If possible, please indicate the specific temperature setback ranges when not occupied.).	PI
	Subschema 9.1 When the outdoor temperature is higher than x℃, reset indoor temperature at a certain point (usually a minimum point) or in the range of x℃-x℃ .	SI
	Subschema 9.2 When the outdoor temperature lower than x℃, reset the indoor temperature at a certain point (usually a maximum point) or in the range of x℃-x℃.	SI
\Control	Subschema 22 1. Open the window first, then use the air conditioner. 2. Use electrical fan, then use the air conditioner.	SI
Space	Subschema 24: supplied in the full space.	PI
	Subschema 25: supplied in part of the space. Indicate the percentage of area or which areas in each zone supplied.	PI

Table 2-27 Item definition of operation of ventilation system in Level C

Ventilation (mechanic) – Centralized/Decentralized

Item	Potential Subschema	SF	MF
Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI	PI
	Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI	PI
	Subschema 4.1 Percentage of fans that are used.	PI	PI
Set Point	N/A		
Control Space	Subschema 11.1: When the indoor temperature/humidity higher than x℃, open it.	SI	SI

	Subschema 11.2:When the indoor temperature/humidity lower than x℃, open it.	SI	SI
	Subschema 12.1:When there is a certain level of CO_2 or CO, open it.	SI	SI
	Subschema 12.2: When there is a certain level of CO_2 or CO, close it.	SI	SI
	Subschema 13.1:Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Subschema	PI	PI
	Subschema 13.2:Gear limit (For example: high/low speed only)	PI	PI
	Subschema 23.1:Object controlled by occupants.	SI	n/a
	Subschema 23.2:Object controlled by building managers.	n/a	SI
	Subschema 24: supplied in the full space.	PI	PI
	Subschema 25: supplied in part of the space. Indicate the percentage of area or which areas in each zone supplied.	PI	PI

Table 2-28 Item definition of operation of lighting in Level C

Lighting

Item	Potential Subschema	SF	MF
Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI	PI
	Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI	PI
	Subschema 4.1 Percentage of lights that are used.	PI	PI
	Subschema 3.2 Fraction of the nominal lighting power (value between 0 and 1) for each hour during business hours, break time, non-business hours (overtime and weekends) and holidays.	PI	PI
	Subschema 26 The change of object's status has no certain discipline, and runs randomly.	SI	SI
Set Point	N/A		
Control	Subschema 14:When the illumination outside is < x lux, open it.	SI	SI
	Subschema 15:When there are the occupants, open or use it.	SI	SI
	Subschema 17.1: When not in use, turned off (appliances and lighting).	SI	SI
	Subschema 17.3:When not in use, left on (appliances and lighting).	SI	SI
	Subschema 23.1 (For personal space)Object controlled by occupants.	SI	SI
	Subschema 23.2(For public space):Object controlled by building managers(For outdoor lighting and public lighting).	SI	SI
Space	Subschema 24: supplied in the full space.	PI	PI
	Subschema 25: supplied in part of the space. Indicate the percentage of area or which areas in each zone supplied.	PI	PI

Table 2-29 Item definition of operation of domestic hot water in Level C

Domestic hot water

Item	Potential Subschema	SF	MF
Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI	PI
	Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI	PI
Set Point	Subschema 6: Always set at a certain point (x℃) for the supply temperature for domestic hot water	PI	PI
	Subschema 7: Usually set the supply temperature of domestic hot water in the range of x(minimum) – y(maximum)	PI	PI
	Subschema 9.1: When the outdoor temperature is higher than x℃, reset the supply temperature of domestic hot water at a certain point (usually a minimum point) or in the range of x℃-x℃ .	SI	SI
	Subschema 9.2: When the outdoor temperature lower than x℃, reset the cold/hot supply air/water temperature, and supply temperature of domestic hot water at a certain point (usually a maximum point) or in the range of x℃-x℃.	SI	SI
	Subschema 10: A certain amount (x litres per person per day) of water use per person as if it is a set point (This subschema could be used for simulation or calculation).	PI	PI
Control	Subschema 17.1: When not in use, turned off	SI	SI
	Subschema 17.2: When not in use, in standby mode	SI	SI
	Subschema 17.3:When not in use, left on	SI	SI
	Subschema 23.1 (For personal space)Object controlled by occupants.	SI	SI
	Subschema 23.2 (For personal space)Object controlled by building manager*.	SI	SI

*Note 1: Subschema 23.2 is only applicable for centralized DHW; others are both applicable for centralized and decentralized DHW.

Table 2-30 Item definition of operation of domestic electric appliances in Level C

Domestic electric appliances

Item	Potential Subschema	SF	MF
Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI	PI
	Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI	PI

	Subschema 4.1 Percentage of appliances that are used.	PI	PI
	Subschema 3.3 Fraction of the nominal appliance power (value between 0 and 1) for each hour during business hours, break time, non-business hours (overtime and weekends) and holidays.	PI	PI
Set Point	N/A		
Control	Subschema 15:When there are the occupants, open or use it.	SI	SI
	Subschema 17.1: When not in use, turned off	SI	SI
	Subschema 17.2: When not in use, in standby mode	SI	SI
	Subschema 17.3:When not in use, left on	SI	SI
	Subschema 23.1 (For personal space)Object controlled by occupants.	SI	SI

Table 2-31 Item definition of operation of other appliances in Level C

Other

Item	Potential Subschema	SF	MF
Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI	PI
	Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI	PI
	Subschema 3.3 Fraction of the nominal appliance power (value between 0 and 1) for each hour during business hours, break time, non-business hours (overtime and weekends) and holidays.	PI	PI
Set Point	N/A		
	Subschema 10 (For hot water use): A certain amount (x litres per person per day) of water use per person as if it is a set point (This subschema could be used for simulation or calculation).	PI	PI
Control	Subschema 15When there are the occupants, open or use it.	SI	SI
	Subschema 17.1: When not in use, turned off	SI	SI
	Subschema 17.2: When not in use, in standby mode	SI	SI
	Subschema 17.3:When not in use, left on	SI	SI
	Subschema 23.1 (For personal space) Object controlled by occupants.	SI	SI
	Subschema 23.2(For public space): Object controlled by building managers.	SI	SI
Space	Subschema 24: supplied in the full space.	PI	PI
	Subschema 25: supplied in part of the space. Indicate the percentage of area or which areas in each zone supplied.	PI	PI

Table 2-32 Item definition of occupant behavior of window opening in Level C

Windows

Item	Potential Subschema	SF	MF

Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI	PI
	Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI	PI
	Subschema 4.1: Percentage of the windows that are opened.	PI	PI
	Subschema 4.3: Percentage of window opening width for each hour of the day when the building is occupied and unoccupied.	PI	PI
	Subschema 26 The change of object's status has no certain discipline, and runs randomly.	SI	SI
Set Point	N/A		
Control	Subschema 11.1: When the indoor temperature/humidity higher than x℃, open it.	SI	SI
	Subschema 11.2:When the indoor temperature/humidity lower than x℃, open it.	SI	SI
	Subschema 12.1: When there is a certain level of CO_2 or CO, open it.	SI	SI
	Subschema 12.1: When there is a certain level of CO_2 or CO, close it.	SI	SI
	Subschema 22: 1. Open the window first, and then use the air conditioner. 2. Use electrical fan, then use the air conditioner.	SI	SI

Table 2-33 Item definition of occupant behavior of curtains/blinds use in Level C

Curtains/blinds

Item	Potential Subschema	SF	MF
Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI	PI
	Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI	PI
	Subschema 4.3 Percentage of shades closed width for each hour of the day when the building is occupied and unoccupied.	PI	PI
	Subschema 26 The change of object's status has no certain discipline, and runs randomly.	SI	SI
Set Point	N/A		
Control	Subschema 14: When the illumination outside is < x lux, open it.	SI	SI
	Subschema 16: When solar irradiation is strong (such as > xJ/(cm2*min)), close it.	SI	SI

3.6 Input into energy performance indicators

Building energy use can be expressed in the three ways according to attachment 3, which are

(1) Energy use of each energy resource, fuel, electricity, cooling and heating, and peak electric demand
(2) Aggregation of energy of primary energy, equivalent electricity, and equivalent CO2 emissions
(3) Normalized energy use in the above two approaches

Table 2-34 Item definitions of energy performance indicators in Level C

Code	Item		Definition	Frequency	Scope	SF	MF
3.6.1	Step 1: Energy Carrier	Fuel consumption	Indicate fuel consumption in J, MJ, or GJ.	Hourly or monthly plus daily for typical weeks in each season	Per end use and per family	PI	PI
3.6.2		Electricity consumption	Indicate electricity consumption in J, MJ, or GJ.	Hourly or monthly plus daily for typical weeks in each season	Per end use and per family	PI	PI
3.6.3		Cooling consumption	Indicate cooling consumption in J, MJ, or GJ.	Hourly or monthly plus daily for typical weeks in each season	Per end use and per family	PI	PI
3.6.4		Heating consumption	Indicate heating consumption in J, MJ, or GJ.	Hourly or monthly plus daily for typical weeks in each season	Per end use and per family	PI	PI
3.6.5		Peak electric demand	Indicate peak electric demand in W or kW.	Hourly or monthly plus daily for typical weeks in each season	Per end use and per family	SI	SI
3.6.6	Step 2: Aggregation of Energy	Aggregation of energy	Provide the aggregation of energy of primary energy, equivalent electricity.	Hourly or monthly plus daily for typical weeks in each season	Per family	PI	PI

3.6.7	Step 3: Normalized Energy Use	Factors related to energy performance indicators	Normalized energy use.	Hourly or monthly plus daily for typical weeks in each season	Per end use and per family	PI	PI

3.7 Indirect factors (OPTIONAL)

The following definitions of indirect factors are suggestions for key indirect factors that influence energy use suitable for single detached houses and multi-family apartment buildings.

Table 2-35 Item definitions of indirect factors in Level C

Code	Category	Parameter	Description	SF	MF
3.7.1	Family factors	Income per household/person	Annual income divided by the number of family members given in US$.	SI	SI
3.7.2		Age of each family member		SI	SI
3.7.3		Gender of each family member		SI	SI
3.7.4	Energy-related attitude of occupants	Concern for saving energy	Subjective assessment of consciousness of occupants of energy conservation: 1) Very concerned; 2) Concerned; 3) Indifferent; 4) Not so concerned; 5) Not concerned at all	SI	SI
3.7.5	thermal environmental satisfaction of occupants	satisfaction of thermal environment	Subjective assessment of thermal environment: 1) Very satisfied; 2) relatively satisfied; 3)indifferent; 4) relatively disatisfied; 5)very disatisfied.	SI	SI

I-3

Three level data typologies for office buildings

Contents

Introduction

The typologies and influencing factors for office buildings are somewhat similar for residential buildings, although the relative importance of the influencing factors is often very different for the two building types, and the detail definitions for some items should be defined based on the actual characteristics of office buildings. For example, the influencing factors of climate, building envelope and other characteristics, indoor environment, and the associated measurement and data, are similar for office buildings and residential buildings. Heating, cooling, and ventilation equipment are very different for residential and commercial buildings, as there are usually central systems and these systems are more complex for office buildings. However, both central systems and individual systems need to define for both residential buildings and office buildings and at the level of that the influencing factors as associated measurement and data are discussed—e.g., "performance, efficiency", the parameters for the two building types are very similar. As for the building operation and human behaviour, the definitions of individual occupants' behaviour are generally the same for the two kinds of buildings, while office buildings still need the definition of building managers' control for service systems. As a result, the discussion for residential buildings above is generally applicable for commercial buildings, except some characteristics specific for office buildings.

List of Symbols/Abbreviations

PI: Primary Importance
SI: Secondary Importance
Y: Yes
N: No
N/A: Not Applicable
IO=individual office building
CO=central office building

1. Simple version for residential buildings – Level A database

In the simple version, principal drivers related to the influencing factors of energy use in the categories of climate, whole building characteristics, building envelope, building services and energy systems, building operation and inputs for the energy performance indicators are defined.

1.1 Climate

Table 3-1 Item definition of occupant behavior of window opening in Level A

Code	Item	Definition	Frequency	IO	CO
1.1.1	HDD and CDD	Indicate the heating degree days and cooling degree days and the reference temperatures used.	Monthly or annual	PI	PI

1.2 Whole building characteristics

Table 3-2 Item definition of whole building characteristics in Level A

Code	Item	Definition	IO	CO
1.2.1	Year built	Indicate the year built by selecting one of the following categories: 1) Before 1920; 2) 1920 to 1945; 3) 1946 to 1959; 4) 1960 to 1969; 5) 1970 to 1979; 6) 1980 to 1989; 7) 1990 to 1999; 8) 2000 to 2009; 9) After 2009.	SI	SI
1.2.2	Number of floors	Indicate the number of floors.	SI	SI
1.2.3	Conditioned and/or heated floor area	The floor area (m^2) of conditioned floor space, as measured at the floor level within the external surfaces of walls enclosing the conditioned space. It includes the attached space, such as basement, attic, if they are conditioned. Indicate the exact conditioned and/or heated floor area –OR– select from one of the following percentages for both cooling and heating. For cooling: 1) Not cooled; 2) 1-50%; 3) 51 to 99%; 4) 100%. For heating: 1) Not heated; 2) 1-50%; 3) 51 to 99%; 4) 100%.	PI	PI
1.2.4	Gross floor area	Gross floor area is calculated including external walls. The attached space should also be included, such as basement, attic, etc.	PI	PI
1.2.5	Type of building	Indicate the type of building: 1) Government office; 2) Business/professional office; 3) Multi-use complex; 4) Other.	PI	PI

1.3 Building envelope

Table 3-3 Item definition of building envelope in Level A

Code	Item	Definition	IO	CO
1.3.1	Material	This includes walls, ceiling, floor, and window material. • Wall material (select one): 1) Brick, stone or stucco; 2) Concrete; 3) Concrete panels; 4) Siding or shingles; 5) Metal panels; 6) Curtain glass; 7) Other • Walls insulated (Y/N?) • Roof material (select one): 1) Brick 2) Concrete; 3) Concrete panels; 4) Stone; 5) Wood; 6) Other • Roof insulated (Y/N?) • Window material o Select one frame type: 1) Aluminium, 2) Plastic steel; 3) Steel, 4) Wood; 5) Other o Select number of panes: 1) Single; 2) Double; 3) Triple; 4) Other o Select one glass type: 1) Flat glass; 2) Insulating glass; 3) Insulating glass-AR; 4) Insulating glass-KR; 5) Low -e; 6) Solar protection glass; 7) Other o Select the percentage of operable windows: 1) Not operable; 2) Less than 10%; 3) 10%-30%; 4) 30%-60%; 5) More than 60%	SI	SI
1.3.2	U-value	Provided for each of the building envelope components above (wall, ceiling, windows, etc.) using the units: W/(m2*K).	PI	PI
1.3.3	Window to wall ratio	Select one of the following: 1) 25 % or less; 2) 25%-35%; 3) 35%-45%; 4) more than 45%. This should exclude the roof area.	PI	PI

1.4 Building services and energy systems

Table 3-4 Item definition of building services and energy systems in Level A

Code	Item	Definition				IO	CO
1.4.1	Space heating - centralized	Type of central space heating system (Select one: 1) District steam hot water; 2) Boilers inside the building; 3) Other)	Fuel type	Total power (w)	Heat capacity of the building (w)	N/A	PI
1.4.2	Space heating - decentralized	Type of decentralized system (Select one or more: 1) Individual space heaters; 2) Furnaces; 3) Other)	Fuel type	Total power (w)	Heat capacity (w)	PI	N/A
1.4.3	Air conditioning - centralized	Type of central air conditioning systems (Select one or more: 1) District chilled water; 2) Heat pump; 3) Central chillers; 4) Evaporative coolers; 5) Other)	Fuel type	Total power (w)	Heat/cooling capacity (w)	N/A	PI

1.4.4	Air conditioning - decentralized	Type of the decentralized air conditioner (Select one or more: 1) Residential-type A/C; 2) Individual room A/C; 3) Other)	Fuel type	Total power (w)	Heat/cooling capacity (w)	PI	N/A
1.4.5	Ventilation - centralized	Type of centralized system (Select one or more: 1) Mechanical exhaust system; 2)Plenum system; 3) Other)	Fuel type	Total power (w)		N/A	PI
1.4.6	Ventilation - decentralized	Type of local fans	Fuel type	Total power (w)		PI	N/A
1.4.7	Lighting	※Types of lighting (Select one or more: 1) Incandescent bulbs; 2) Fluorescent bulbs; 3) Compact fluorescent bulbs; 4) LEDs; 5) Other) including indoor and outdoor lighting	Fuel type	Total power (w)		SI	SI
1.4.8	Office appliances	※Type(s) of appliances (Select one or more: 1) Computer, including monitor; 2) Server; 3) Copier; 4) Scanner; 5) Telephone/fax; 6) Printer; 7) Teleconference system; 8) Other)	Fuel type	Total power (w)		SI	SI
1.4.9	Other	※Types of other equipment used in the building. Select one or more: • Kitchen appliances: 1) Oven; 2) Cooktop; 3) Microwave; 4) Coffee maker; 5) Toaster oven; 5) Refrigerator; 6) Separate freezer; 7) Dishwasher; 7) Toaster; 8) Other • Water heating appliances: 1) District hot water; 2) Central hot water system; 3) Hot water at point sources; 4) Other • Other: 1) Elevator; 2) Security monitors; 3) Other	Fuel type	Total power (w)		SI	SI

Note 1: If possible, please indicate the detailed types of lighting, office appliances and other equipment in 1.4.7, 1.4.8, 1.4.9

1.5 **Building operation**

Table 3-5 Item definition of building operation in Level A

Code	Item	Mode	Schedule	IO	CO
1.5.1	Business Hours		Typical business hours on weekdays, weekends and holidays.	SI	SI
1.5.2	Occupancy schedule		Number of employees or typical occupancy schedule during business hours, non-business hours (overtime and weekends) and holidays.	SI	SI
1.5.3	Space heating	Select one of the following modes: 1) Full space, full time; 2) Full space, only occupied time; 3) Only occupied space, full time; 4) Only occupied space, only occupied time.	Provide the following: 1) Running hours during business/non-business hours for each season; 2) Running hours during weekday/weekend hours for each season	SI	SI
1.5.4	Space cooling	Select one of the following modes: 1) Full space, full time; 2) Full space, only occupied time; 3) Only occupied space, full time; 4) Only occupied space, only occupied time.	Provide the following: 1) Running hours during business/non-business hours for each season; 2) Running hours during weekday/weekend hours for each season	SI	SI
1.5.5	Ventilation (mechanic) - basement/ garage	Select one of the following modes: 1) Full space, full time; 2) Full space, only occupied time; 3) Only occupied space, full time; 4) Only occupied space, only occupied time.	Provide the following: 1) Number of hours turned on during weekday/weekend	SI	SI
1.5.6	Ventilation (mechanic) - rooms	Select one of the following modes: 1) Full space, full time; 2) Full space, only occupied time; 3) Only occupied space, full time; 4) Only occupied space, only occupied time.	Provide the following: 1) Number of hours turned on during weekday/weekend	SI	SI
1.5.7	Ventilation (mechanic) - – toilets/kitchen	Select one of the following modes: 1) Full space, full time; 2) Full space, only occupied time; 3) Only occupied space, full time; 4) Only occupied space, only occupied time.	Provide the following: 1) Number of hours turned on during weekday/weekend	SI	SI
1.5.7	Lighting	Select one of the following modes: 1) Full space, full time; 2) Full space, only occupied	Provide the following: 1) Range of running hours for business/non-business hours and	SI	SI

		time; 3) Only occupied space, full time; 4) Only occupied space, only occupied time.	weekdays/weekends		
1.5.8	Office appliances	Select one of the following modes for personal devices (i.e., desktop, monitor, laptop, personal printer, etc.): 1) Full time (turned on 24 hours/day) 2) Standby when not in use 3) Only turn on when in use, off when not in use Select one of the following modes for public devices (i.e., public printer, copier, water fountain, etc.): 1) Full time (turned on 24 hours/day) 2) Turn off during off hours 3) Standby during off hours 4) Only turn on when in use, off when not in use	Provide the following: 1) Range of running hours for business/non-business hours and weekdays/weekends	SI	SI

1.6 Input into energy performance indicators

Building energy use can be expressed in the three ways according to Appendix A1, which are:

(1) Energy use of each energy resource,
(2) Aggregation of energy of primary energy, equivalent electricity, and equivalent CO2 emissions,
(3) Normalized energy use in the above two approaches

Table 3-6 Item definition of energy performance indicators in Level A

Code	Item	Definition	Frequency	Scope	IO	CO
1.6.1	Step 1: Energy carrier	Indicate the energy use of each energy resource.	Monthly or annual	For each business in building or whole building	SI	SI
1.6.2	Step 2: Aggregation of energy	Provide the aggregation of primary energy and equivalent electricity by the methodology provided in I-1.	Monthly or annual	For each business in building or whole building	PI	PI
1.6.3	Step 3: Normalized energy use	Normalized energy use using the above two approaches	Monthly or annual	For each business in building or whole building	PI	PI

2. Intermediate version for residential buildings – Level B database

The intermediate version is more detailed and includes more items, when compared with the simple version. It defines the influencing factors of six categories: climate, indoor thermal environment, building characteristics, building envelope, building service and energy system, building operation and occupant behaviour. In each category, the important items that affect energy use are listed and defined.

2.1 Climate and indoor thermal environment

The following table lists the items used to describe the climate and indoor thermal environment. For each item, the measured frequency and location are defined.

Table 3-7 Item definition of climate and indoor thermal environment in Level B

Code	Item	Frequency	Location	IO	CO
2.1.1	HDD and CDD	Monthly or annual	N/A	PI	PI
2.1.2	Weather data	Daily or monthly (Indicate if hourly weather data are available (yes/no)).	Provide weather data including ambient temperature, humidity, and direct/diffuse solar radiation at the nearest weather station.	PI	PI
2.1.3	Indoor temperature (°C)	Daily indoor temperature or daily indoor temperature of typical days on weekdays/weekends in each season	Indicate the measured indoor temperature for each HVAC zone or the whole building.	PI	PI
2.1.4	Indoor humidity	Daily indoor humidity or daily indoor humidity of typical days on weekdays/weekends in each season	Indicate the measured indoor humidity for each HVAC zone or the whole building.	SI	SI
2.1.5	Indoor illumination	Daily indoor illumination or daily indoor illumination of typical days on weekdays/weekends in each season	Indicate the measured indoor illumination for each functional zone or the whole building.	SI	SI

2.2 Whole building characteristics

Table 3-8 Item definition of whole building characteristics in Level B

Code	Item	Definition	IO	CO
2.2.1	Year built	Indicate the year built by selecting one of the following categories: 1) Before 1920; 2) 1920 to 1945; 3) 1946 to 1959; 4) 1960 to 1969; 5) 1970 to 1979; 6) 1980 to 1989; 7) 1990 to 1999; 8) 2000 to 2009; 9) After 2009.	SI	SI
2.2.2	Number of floors	Indicate the number of floors.	SI	SI

2.2.3	Conditioned and/or heated floor area	The floor area of conditioned floor space, as measured at the floor level within the external surfaces of walls enclosing the conditioned space. It includes the attached space, such as basement, attic, if they are conditioned. Indicate the exact conditioned and/or heated floor area –OR– select from one of the following percentages for both cooling and heating. For cooling: 1) Not cooled; 2) 1-50%; 3) 51 to 99%; 4) 100%. For heating: 1) Not heated; 2) 1-50%; 3) 51 to 99%; 4) 100%.	PI	PI
2.2.4	Gross floor area	Gross floor area is calculated including external walls of the building. The attached space should also be included, such as basement, attic, etc.	PI	PI
2.2.5	Average number of occupants	Average number of occupants that are normally in the building.	PI	PI
2.2.6	Type of building	Indicate the type of building: 1) Government office; 2) Business/professional office; 3) Multi-use complex; 4) Other.	SI	SI
2.2.7	Building activity areas	Select one or more of the following: 1) Office; 2) Conference room; 3) Lobby; (4) Copy room; 5) Restroom; 6) Corridor; 7) Garage; 8) Data centre; 9) Food sales/food service; 10) Warehouse/storage; 11) Vacant; 12) Other.	PI	PI
2.2.8	Gross floor area occupied by each activity	Provide floor area for all space/activity types listed in 2.2.7	PI	PI

2.3 **Building envelope and other components**

Table 3-9 Item definition of building envelope and other components in Level B

Code	Item	Definition	IO	CO
2.3.1	Material	This includes walls, ceiling, floor, and window material. • Wall material (select one): 1) Brick, stone or stucco; 2) Concrete; 3) Concrete panels; 4) Siding or shingles; 5) Metal panels; 6) Curtain glass; 7) Other • Wall insulation material: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Batt; 5) Fiberboard sheathing; 6) Rockwool; 7) Other; 8) No insulation • Roof material (select one): 1) Brick 2) Concrete; 3) Concrete panels; 4) Stone; 5) Wood; 6) Other • Roof insulation material: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Batt; 5) Fiberglass; 6) Rockwool; 7) Others; 8) No insulation • Floor material (select one): 1) Brick; 2) Concrete; 3) Stone; 4) Stucco; 5) Other • Floor insulation material: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Other; 5) No insulation • Window material o Select one frame type: 1) Aluminum, 2) Plastic steel; 3) Steel, 4) Wood; 5) Other	PI	PI

		○ Select number of panes: 1) Single; 2) Double; 3) Triple; 4) Other ○ Select one glass type: 1) Flat glass; 2) Insulating glass; 3) Insulating glass-AR; 4) Insulating glass-KR; 5) Low-e; 6) Other • Select the percentage of operable windows: 1) Not operable; 2) Less than 10%; 3) 10%-30%; 4) 30%-60%; 5) More than 60% • Shading system ○ Select one or more: 1) External overhangs; 2) Awnings; 3) Solar screens; 4) Solar film; 5) Other ○ Indicate: 1) Exterior; 2) Interior; 3) Within glazing system/façade system 4) Other		
2.3.2	U-value	Provided for all of the building envelope materials (wall, ceiling, windows, etc.) using the units: w/(m^2*k).	PI	PI
2.3.3	Comprehensive shading coefficient of the windows	This coefficient considers the shading effects of both windows and exterior shading. It equals the shading coefficient of windows multiplied by the shading coefficient of exterior shading. This can also be solar factor.	SI	SI
2.3.4	Solar heat gain coefficient	Provide the solar heat gain coefficient of the glazing.	SI	SI
2.3.5	Window to wall ratio	Select one of the following: 1) 25 % or less; 2) 25%-35%; 3) 35%-45%; 4) more than 45%. This should exclude the roof area.	PI	PI

2.4 Building services and energy systems

Table 3-10 Item definition of building services and energy systems in Level B

Code	Item	Definition						IO	CO
2.4.1	Space heating – centralized	Type of central space heating system (Select one: 1) District steam hot water; 2) Boilers inside the building; 3) Other)	Number of systems	Fuel type	Total power (w)	Heat capacity of the bldg.(w)	Floor area of zone served by each type of system	N/A	PI
2.4.2	Space heating - decentralized	Type of decentralized system (Select one or more: 1) Individual space heaters; 2) Furnaces; 3) Other)	Number of each type of heater	Fuel type	Total power (w)			PI	N/A

2.4.3	Air conditioning - centralized	Type of central air conditioning systems (Select one or more: 1) District chilled water; 2) Heat pump; 3) Central chillers; 4)Evaporative coolers; 5)Natural heat sink; 6) Other)	Number of systems	Fuel type	Total power (w)	Heat/ cooling capacity of the bldg. (w)	Floor area of zone served by each type of system	N/A	PI
2.4.4	Air conditioning - decentralized	Type of the decentralized air conditioner (Select one or more: 1) Residential-type A/C; 2) Individual room A/C; 3) Other)	Number of each type of air conditioner	Fuel type	Total power (w)	Heat/cooling capacity (w)		PI	N/A
2.4.5	Ventilation - centralized	Type of centralized system (Select one or more: 1) Mechanical exhaust; 2) Plenum system; 3) Other)	Number of systems	Fuel type	Total power (w)			N/A	PI
2.4.6	Ventilation - decentralized	Type of local fans	Number of fans	Fuel type	Total power (w)			PI	N/A
2.4.7	Lighting	Types of lighting (Select one or more: 1) Incandescent bulbs; 2) Fluorescent bulbs; 3) Compact fluorescent bulbs; 4) LEDs; 5) Other) including indoor and outdoor lighting	Number of lighting appliances	Fuel type	Total power (w)	Control method (photo/ occupancy/scheduling)		PI	PI
2.4.8	Office appliances	Type(s) of appliances (Select one or more: 1) Computer, including monitor; 2) Server; 3) Copier; 4) Scanner; 5) Telephone/fax; 6) Printer; 7) Teleconference system; 8) Other)	Number of appliances	Fuel type	Total power (w)			PI	PI

2.4.9	Other	Types of other equipment used in the building. Select one or more: Kitchen appliances: 1) Oven; 2) Cooktop; 3) Microwave; 4) Coffee maker; 5) Toaster oven; 5) Refrigerator; 6) Separate freezer; 7) Dishwasher; 7) Toaster; 8) Other Water heating appliances: 1) District hot water; 2) Central hot water system; 3) Hot water at point sources; 4) Other Other: 1) Elevator; 2) Security monitors; 3) Other	Number of appliances	Fuel type	Total power (w)			SI	SI

2.5 Building operation and occupant behavior

2.5.1 Occupancy

Table 3-11 Item definition of occupancy in Level B

Code	Item	Space mode	Time mode	Schedule	Set point	IO	CO
2.5.1	Business Hours	N/A	N/A	Typical business hours on weekdays, weekends and holidays.	N/A	PI	PI
2.5.2	Occupancy schedule	N/A	N/A	Fraction of the nominal occupancy (value between 0 and 1) for each hour during business hours, non-business hours (overtime and weekends) and holidays.	N/A	PI	PI

2.5.2 Technical building systems

In office buildings, both building managers and occupants can control the operation of technical building systems. Therefore, definitions of building operation and occupant behaviour are suitable for both building managers and occupants, and building operation and controls by both building managers and occupants should be recorded.

Table 3-12 Item definition of the operation of technical building systems in Level B

Code	Item	Space and time mode	Schedule	Set point	IO	CO
2.5.3	Space heating - centralized	Select one of the following modes: 1) Full space, full time; 2) Full space, only occupied time; 3) Only occupied space, full time; 4) Only occupied space, only occupied time.	Provide the following: 1) Running hours during business/non-business hours for each season; 2) Running hours during weekday/ weekend hours for each season; 3) Hours when indoor temperature is set back on weekday/ weekend, separately.	Provide the following: 1) Set point; 2) Range of set points; 3) If possible indicate set points when occupied and unoccupied.	N/A	PI
2.5.4	Space heating - decentralized	Select one of the following modes: 1) Full space, full time; 2) Full space, only occupied time; 3) Only occupied space, full time; 4) Only occupied space, only occupied time.	Provide the following: 1) Running hours during business/non-business hours for each season; 2) Running hours during weekday/ weekend hours for each season; 3) Hours when indoor temperature is set back on weekday/ weekend, separately.	Provide the following: 1) Set point; 2) Range of set points; 3) If possible indicate set points when occupied and unoccupied.	PI	N/A
2.5.5	Space cooling - centralized	Select one of the following modes: 1) Full space, full time;	Provide the following: 1) Running hours during business/non-business	Provide the following: 1) Set point; 2)	N/A	PI

		2) Full space, only occupied time; 3) Only occupied space, full time; 4) Only occupied space, only occupied time.	hours for each season; 2) Running hours during weekday/ weekend hours for each season; 3) Hours when indoor temperature is set back on weekday/ weekend, separately.	Range of set points; 3) If possible indicate set points when occupied and unoccupied.		
2.5.6	Space cooling - decentralized	Select one of the following modes: 1) Full space, full time; 2) Full space, only occupied time; 3) Only occupied space, full time; 4) Only occupied space, only occupied time.	Provide the following: 1) Running hours during business/non-business hours for each season; 2) Running hours during weekday/ weekend hours for each season; 3) Hours when indoor temperature is set back on weekday/ weekend, separately.	Provide the following: 1) Set point; 2) Range of set points; 3) If possible indicate set points when occupied and unoccupied.	PI	N/A
2.5.7	Ventilation (mechanic) - Toilet/kitchen	Select one of the following modes: 1) Full space, full time; 2) Full space, only occupied time; 3) Only occupied space, full time; 4) Only occupied space, only occupied time.	Provide the following: 1) Times of use on weekday/ weekend and minutes per time; 2) Hours on weekday/weekend.	N/A	SI	SI
2.5.8	Ventilation (mechanic) - basement/garage	Select one of the following modes: 1) Full space, full time; 2) Full space, only occupied time; 3) Only occupied space, full time; 4) Only occupied space, only occupied time.	Provide the following: 1) Number of hours turned on during weekday/ weekend; 2) Portion of appliances running on weekday/ weekend hours.	Power level used	PI	PI
2.5.9	Ventilation (mechanic) - rooms	Select one of the following modes: 1) Full space, full time; 2) Full space, only occupied time; 3) Only occupied space, full time; 4) Only occupied	Provide the following: 1) Number of hours turned on during weekday/ weekend; 2) Portion of appliances running on weekday/weekend hours.	Power level used	PI	PI

		space, only occupied time.				
2.5.10	Lighting	Select one of the following modes: 1) Full space, full time; 2) Full space, only occupied time; 3) Only occupied space, full time; 4) Only occupied space, only occupied time.	Provide the following: 1) Range of running hours for business/non-business hours and weekdays/ weekends; 2) Percentage of lights on when occupied and unoccupied and on weekday and weekend.		PI	PI
2.5.11	Office appliances	Select one of the following modes for personal devices (e.g., desktop, monitor, laptop, personal printer, etc.): 1) Full time (turned on 24 hours/day) 2) Standby when not in use 3) Only turn on when in use, off when not in use Select one of the following modes for public devices (e.g., public printer, copier, water fountain, etc.): 1) Full time (turned on 24 hours/day) 2) Turn off during off hours 3) Standby during off hours 4) Only turn on when in use, off when not in use	Provide the following: 1) Range of running hours for business/non-business hours and weekdays/ weekends; 2) Percentage of appliances on when occupied and unoccupied and on weekday and weekend.		PI	PI
2.5.12	Other (Cooking appliances, water	N/A	Provide the following: 1) Range of running hours; 2) Percentage of appliances running	N/A	SI	SI

	heating appliances, other)		weekday and weekend.			

2.5.3 **Windows, shading and curtains **OPTIONAL****

Table 3-13 Item definition of the occupant behaviour of window, shading and curtains use in Level B

Code	Item	Space and time mode	Control	Schedule	Set point	IO	CO
2.5.13	Windows	N/A	Select one of the following for control method: 1) Occupant; 2) Manager; 3) Other	Provide the following: 1) Times of use per day and minutes per use; 2) Hours open during day/night and week/weekend.	N/A	SI	SI
2.5.14	Curtains/ blinds	N/A	Select one of the following for control method: 1) Occupant; 2) Manager; 3) Other	Provide the following: 1) Times of use per day and minutes per use; 2) Hours open during day/night and week/weekend.	N/A	SI	SI

2.6 **Input into energy performance indicators**

Building energy use can be expressed in the three ways according to Appendix A1, which are:

(1) Energy use of each energy resource, fuel, electricity, cooling and heating, and peak electric demand
(2) Aggregation of energy of primary energy, equivalent electricity;
(3) Normalized energy use in the above two approaches

Table 3-14 Item definition of energy peroformance indicators in Level B

Code	Item		Definition	Frequency	Scope	IO	CO
2.6.1	Step 1: Energy Carrier	Fuel consumption	Indicate fuel consumption in J, MJ, or GJ.	Daily or monthly	Per end use or whole building.	PI	PI
2.6.2		Electricity consumption	Indicate electricity consumption in J, MJ or GJ.	Daily or monthly	Per end use or whole building.	PI	PI
2.6.3		Cooling consumption	Indicate cooling consumption in J, MJ or GJ.	Daily or monthly	Per end use or whole building.	PI	PI
2.6.4		Heating consumption	Indicate heating consumption in J, MJ or GJ.	Daily or monthly	Per end use or whole building.	PI	PI

2.6.5		Peak electric demand	Indicate peak electric demand in W or kW.	Daily or monthly	N/A	SI	SI
2.6.6	Step 2: Aggregation of Energy		Provide the aggregation of primary energy and equivalent electricity by the methodology provided in Appendix I-1.	Daily or monthly	Per whole building.	PI	PI
2.6.7	Step 3: Normalized Energy Use	Factors related to energy performance indicators	Normalized energy use.	Daily or monthly	Per end use or whole building.	PI	PI

3. Complex version for office buildings – Level C database

3.1 Climate and indoor thermal environment

Table 3-15 Item definition of climate and indoor thermal environment in Level C

Code	Item	Frequency	Location	IO	CO	Parameter Used for Simulation (Y/N/?)
3.1.1	HDD and CDD	Monthly or annual.	N/A	PI	PI	N Y
3.1.2	Weather data	Hourly or daily		PI	PI	
3.1.3	Indoor temperature (°C)	Hourly, daily or seasonal, weekday/weekend or day/night.	Indicate the indoor temperature for each HVAC zone or the whole building.	PI	PI	Y
3.1.4	Ventilation rate	Daily or seasonal, weekday/weekend or day/night.	Indicate the indoor ventilation rate for each activity area or the whole building.	PI	PI	N
3.1.5	Indoor humidity	Hourly, daily, or seasonal, weekday/weekend or day/night.	Indicate the indoor humidity for each HVAC zone or the whole building.	SI	SI	N
3.1.6	Indoor illumination	Daily or seasonal, weekday/weekend or day/night.	Indicate the indoor illumination for each activity zone or the whole building.	SI	SI	N
3.1.7	Index pollutants concentrations	Daily or seasonal, weekday/weekend or day/night.	Indicate the TVOC concentration for each activity zone or the whole building.	SI	SI	N

	(e.g., formaldehyde, benzene, methylbenzene, xylene,CO2, CO, SO2, NO2, TVOC, PM10, pm2.5, NH3,O3,)					

3.2 Whole building characteristics

Table 3-16 Item definition of whole building characteristics in Level C

Code	Item	Definition	IO	CO	Parameter Used for Simulation (Y/N/?)
3.2.1	Year built	Indicate the year built by selecting one of the following categories: 1) Before 1920; 2) 1920 to 1945; 3) 1946 to 1959; 4) 1960 to 1969; 5) 1970 to 1979; 6) 1980 to 1989; 7) 1990 to 1999; 8) 2000 to 2009; 9) After 2009.	PI	PI	Y
3.2.2	Number of floors	Indicate the number of total floors, the number of floors above grade and below grade	PI	PI	Y
3.2.3	Gross floor area	Gross floor area is calculated including external walls of the building. The attached space should also be included, such as basement, attic, etc.	PI	PI	Y
3.2.4	Conditioned, heated, semi-conditioned and unconditioned floor area	Indicate the floor area of (1) conditioned, (2) heated, (3) semi-conditioned and (4) unconditioned space. It includes the attached space, such as basement, attic, if they are conditioned, heated or semi-conditioned/heated.	PI	PI	Y
3.2.5	Number of businesses	The number of companies occupying the building.	SI*	SI	N
3.2.6	Number of employees	Indicate the number of employees per business (preferred), total number of employees in the building (acceptable).	PI	PI	N
3.2.7	Designed occupant density	Indicate the designed occupant density or densities, the maximum number of occupant floor area (m^2).	SI	SI	Y
3.2.8	Type of building	Indicate the type of building: 1) Government office; 2) Business/professional office; 3)	SI	SI	Y

		Multi-use complex; 4) Other			
3.2.9	Building activity areas	Select one or more of the following: 1) Office; 2) Conference room; 3) Lobby; (4) Copy room; 5) Restroom; 6) Corridor; 7) Garage; 8) Data centre; 9) Food sales/food service; 10) Warehouse/storage; 11) Vacant; 12) Other.	PI	PI	Y
3.2.10	Ownership	Indicate whether the building is: 1) rented; 2) owned; 3) leased	SI	SI	N
3.2.11	Net floor area	Calculated using the internal dimensions of building.	SI	SI	N
3.2.12	Gross floor area occupied by each activity	Provide floor area for all space/activity types listed in 3.2.8	PI	PI	Y
3.2.13	Building geographical position	Provide the longitude, latitude and ASL.	PI	PI	Y
3.2.14	Planar graph	Provide floor plans or an elevation drawing for simulation use.	PI	PI	Y
3.2.15	Orientation	Provide the orientation of main façades.	PI	PI	Y

3.3 Building envelope and other components

Table 3-17 Item definition of building envelope and other components in Level C

Code	Item	Definition	IO	CO	Parameter Used for Simulation (Y/N/?)
3.3.1	Building air tightness	Air change rate provided in times/hour.	PI	PI	Y
3.3.2	Wall material	Wall material (select one or more): 1) Brick, stone or stucco; 2) Concrete; 3) Concrete panels; 4) Siding or shingles; 5) Metal panels; 6) Curtain glass; 7) Other	PI	PI	Y
3.3.3	Roof material	Ceiling material (select one): 1) Brick 2) Concrete; 3) Concrete panels; 4) Stone; 5) Wood; 6) Other	PI	PI	Y
3.3.4	Window material	Indicate the frame type, number of panes, glass type and percentage of operable windows. 1. Options for glass type: 1) Flat glass; 2) Insulating glass; 3) Insulating glass-AR; 4) Insulating glass-KR; 5) Low -e; 6) Other 2. Select number of panes: 1) Single; 2) Double; 3) Triple; 4) Other 3. Select one frame type: 1) Aluminum, 2) Plastic steel; 3) Steel, 4) Wood; 5) Vinyl; 6) Other 4. Select the percentage of operable window: 1) Not operable; 2) less than 10%; 3) 10%-30%;	PI	PI	Y

		4) 30%-60%; 5) more than 60%.			
3.3.5	Floor material	Floor material (select one): 1) Brick; 2) Concrete; 3) Stone; 4) Stucco; 5) Other	PI	PI	Y
3.3.6	Interior ceiling construction	1) "Lay-In Acoustic Tile; 2)"Drywall Finish; 3)Plaster Finish; 4)others; 5)None	SI	SI	Y
3.3.7	Insulation material	Indicate the insulation materials for wall, ceiling, ground floor, basement wall, basement floor and roof. • Options for wall: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Batt; 5) Fiberboard sheathing; 6) Rockwool; 7) Other; 8) No insulation • Options for roof: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Batt; 5) Fiberglass; 6) Rockwool; 7) Others; 8) No insulation • Options for ground floor: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Other; 5) No insulation • Options for basement wall: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Batt; 5) Fiberboard sheathing; 6) Rockwool; 7) Other; 8) No insulation • Options for basement floor: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Other; 5) No insulation • Options for roof: 1) Loose fill; 2) Batts; 3) Spray-on; 4) Rigid; 5) Unknown insulation; 6) Not insulated; 7) Other	PI	PI	Y
3.3.8	Material thickness	Provide the thickness of materials listed in 3.3.2 through 3.3.7.	PI	PI	Y
3.3.9	Area of the components	Provide the area of the exterior walls, roof, and windows	SI	SI	Y
3.3.10	Shading system	• Shading system (select one or more): 1) Exterior shading; 2) Interior shading; 3) Within glazing system/façade system • Exterior shading: 1) Awnings, 3) Solar screens; 4) Solar film; 5) Blinds; 6) Other; 7) None • Interior shading: 1) blinds; 2) Shading cloths; 3) Other; 4) None	SI	SI	Y
3.3.11	U-value	Provide for all of the building envelope materials provided in 3.3.2 through 3.3.7 the units: W/(m2*K).	PI	PI	Y
3.3.1.2	Comprehen sive shading	This coefficient considers the shading effects of both windows and exterior shading. It equals the	PI	PI	N

	coefficient of the windows	shading coefficient of windows multiplied by the shading coefficient of exterior shading. This can also be solar factor.			
3.3.13	Window to wall ratio	Provide the value for each façade.	PI	PI	Y
3.3.14	Solar heat gain coefficient	Provide the solar heat gain coefficient of glazing.	SI	SI	Y
3.3.15	Shape factor	The ratio of surface area that is exposed to the outside area to the enclosed volume, and the surface area does not include the floor area, door area and internal wall area of the stairwells without district space heating.	SI	SI	Y
3.2.16	Curtains/blinds	Provide the material and colour of curtains/blinds.	SI*	SI*	Y

3.4 Building services and energy systems

Table 3-18 Item definition of building service and energy systems in Level C

Code	Category	Item	Parameters	IO	CO	Parameter Used for Simulation (Y/N/?)
3.4.1	Air conditioning - centralized	Parameters used for the overall system	Heating/Cooling Indoor Design Temperature: The indoor temperature to be used to size airflow for the system type. Heating/Cooling Indoor Design Temperature should be greater/less than or equal to the Thermostat Cooling Set Point	N/A	PI	Y
			Ventilation Rate Per Occupant: The minimum allowable flow rate of outside ventilation air per person (based on peak occupancy).	N/A	SI	Y
			Other overall performance	N/A	SI	N
		Heat source(s)	Type(s) of heating sources (select one or more): 1) Boilers; 2) Heat pumps; 3) Other	N/A	PI	Y
			Number of each type of component	N/A	PI	Y
			Energy type	N/A	PI	Y
			Power rating (kw)	N/A	PI	Y
			Heat capacity supplied by each type of the heat sources	N/A	PI	Y

			Control method: 1) Programmable thermostat; 2) Manual thermostat; 3) Digital thermostat; 4) Timer; 5) Part of EMCS; 6) Other	N/A	SI	N
			Heat source efficiency (COP)	N/A	PI	Y
			Energy efficiency label or not	N/A	SI	N
		Cooling source(s)	Type(s) of cooling sources (select one or more): 1) Heat pumps; 2) Central chillers inside the building; 3) Evaporative or swamp coolers; 4) Condenser; 5) Natural heat sink; 6) Other	N/A	PI	Y
			Number of each type of component	N/A	PI	Y
			Energy type	N/A	PI	Y
			Cooling source efficiency (EER)	N/A	PI	Y
			Power rating (kw)	N/A	PI	Y
			Cooling capacity supplied by each type of cooling sources	N/A	PI	Y
			Control method: 1) Programmable thermostat; 2) Manual thermostat; 3) Digital thermostat; 4) Timer; 5) Part of EMCS; 6) Other	N/A	SI	N
			Energy efficiency label or not	N/A	SI	N
		3) District space heating/ cooling	Number of pumps	N/A	PI	Y
			Water volume	N/A	PI	Y
			Head for pumps	N/A	PI	Y
			Total power of pumps	N/A	PI	Y
			Heating/cooling capacity	N/A	PI	Y
			Efficiency of the heat pipe network (please indicate length of pipes and thickness of insulation if possible)	N/A	SI	N
		4) Chilled water pump	Number of appliances	N/A	PI	Y
			Water volume	N/A	PI	Y
			head for pumps	N/A	PI	Y
			Total power of pumps	N/A	PI	Y
			Pump efficiency (standard, high, premium)	N/A	SI	Y
			Energy efficiency label or not	N/A	SI	Y
		5) Cooling water pump:	Number of appliances	N/A	PI	Y
			Water volume	N/A	PI	Y
			Head for pumps	N/A	PI	Y

		fixed-frequency/ frequency conversion	Total power of pumps	N/A	PI	Y
			Fan/pump efficiency (standard, high, premium)	N/A	SI	Y
			Energy efficiency label or not	N/A	SI	N
		6) AHU	Number of appliances	N/A	PI	Y
			Total power	N/A	PI	Y
			Fan efficiency (standard, high, premium)	N/A	SI	Y
			Energy efficiency label or not	N/A	SI	N
		7) FCU: Two-pipe fan coil; Three pipe fan coil; Four pipe fan coil	Number of appliances	N/A	PI	Y
			Minimum design airflow: Used to set a "floor" (i.e., minimum) for the design airflow supplied to each space. Minimum design airflow pertains to airflow at design (maximum) conditions.	N/A	SI	Y
			Fan efficiency (standard, high, premium)	N/A	SI	Y
			Total power	N/A	PI	Y
			Energy efficiency label or not	N/A	SI	N
		8) Radiative unit	Type of the units: 1) Radiators; 2) Floor radiative system; 3) Wall radiative systems; 4) Ceiling radiative systems; 5) Other	N/A	PI	N
		9) Cooling Tower	Number of appliances	N/A	PI	Y
			Volume of cooling water (m^3/h), air volume (m^3/h)	N/A	SI	Y
			Total power	N/A	PI	Y
			Energy efficiency label or not	N/A	SI	N
		10) Pumps of cooling storage systems	Number of appliances	N/A	SI	Y
			Head for pumps	N/A	SI	Y
			Total power	N/A	PI	Y
			Pump efficiency (standard, high, premium)	N/A	SI	Y
			Energy efficiency label or not	N/A	SI	N
		11) Heat exchanger	Number of appliances	N/A	PI	Y
			Area of heat exchange for heat exchangers	N/A	PI	N

			Energy efficiency label or not	N/A	SI	N
		12) Economizer	Number of appliances	N/A	PI	Y
			High limit temperature: This specifies the maximum allowable outside air temperature for which the economizer is enabled.	N/A	PI	Y
			Energy efficiency label or not	N/A	SI	N
		13) Other	Other	N/A	SI	N
3.4.2	Space heating - Centralized	3) Heat source(s)	Type(s) of heating sources (select one or more): 1) District steam hot water; 2) Boilers inside the building; 3) Other)	N/A	PI	Y
			Number of each type of component	N/A	PI	Y
			Energy type	N/A	PI	Y
			Power rating (kw)	N/A	PI	Y
			Heat capacity supplied by each type of the heat sources	N/A	PI	Y
			Control method: 1) Programmable thermostat; 2) Manual thermostat; 3) Digital thermostat; 4) Timer; 5) Part of EMCS; 6) Other	N/A	SI	N
			Energy efficiency of the boiler (COP)	N/A	PI	Y
			Energy efficiency label or not	N/A	SI	N
		4) Hot water pumps	Number of appliances	N/A	PI	Y
			Water volume	N/A	PI	Y
			head for pumps	N/A	PI	Y
			Total power of pumps	N/A	PI	Y
			Pump efficiency (standard, high, premium)	N/A	SI	Y
			Energy efficiency label or not	N/A	SI	N
		3) Radiative unit	Type of the units: 1) Radiators; 2) Floor radiative system; 3) Wall radiative systems; 4) Ceiling radiative systems; 5) Other	N/A	PI	N
		4) Heat exchanger	Number of appliances	N/A	PI	Y
			Area of heat exchange for heat exchangers	N/A	S	N

			Energy efficiency label or not	N/A	SI	N
		5) Economizer	Number of appliances	N/A	PI	Y
			High limit temperature: This specifies the maximum allowable outside air temperature for which the economizer is enabled.	N/A	SI	Y
			Energy efficiency label or not	N/A	SI	N
3.4.3	Space heating - decentralized	Type of decentralized system (Select one or more: 1) Individual space heaters; 2) Furnaces; 3) Other)	Number of each type of heater	PI	N/A	N
			Fuel type	PI	N/A	Y
			Total power (w)	PI	N/A	Y
			Power rating of each type(w)	PI	N/A	Y
			Heat/cooling capacity (w)	PI	N/A	Y
			Energy efficiency label or not	SI	N/A	N
			Other performance	SI	N/A	N
3.4.4	Air conditioning - decentralized		Type of local air conditioner(s), humidifier and dehumidifier (Select one or more: 1); 1) Individual room A/C; 2) Other)	PI	N/A	N
			Number of each type of air conditioner	PI	N/A	N
			Fuel type	PI	N/A	Y
			Power rating of each type(w)	PI	N/A	Y
			Heat/cooling capacity (w)	PI	N/A	Y
			Energy efficiency label or not	SI	N/A	N
			Other performance (humidification/dehumidification capacity)	SI	N/A	N
3.4.5	Ventilation - centralized		Number of each type	N/A	PI	N
			Type of centralized system (Select one or more: 1) Mechanical exhaust; 2) Plenum system; 3) Heat exchanger(if used with separate ventilation systems);; 4) Local humidifier and dehumidifier (if used with separate ventilation systems);5) Other)	N/A	PI	N
			Power intensity of each building activity area(w)	N/A	PI	Y
			Pump efficiency (standard, high, premium)	N/A	PI	Y

		Locations served (select one or more): 1) Garage; 2) Basement; 3) Offices; 4) Restrooms; 6) Corridors; 7) Lobby; 8) Other	N/A	PI	Y
		Other performance such as ventilation rate	N/A	SI	N
3.4.6	Ventilation - decentralized	Number of fans	SI	N/A	N
		Power intensity of each building activity area (w)	PI	N/A	Y
		Pump efficiency (standard, high, premium)	SI	N/A	Y
		Locations served (select one or more): 1) Garage; 2) Basement; 3) Offices; 4) Restrooms; 6) Corridors; 7) Lobby; 8) Other	SI	N/A	Y
3.4.7	Lighting	Types of lighting (Select one or more: 1) Incandescent bulbs; 2) Fluorescent bulbs; 3) Compact fluorescent bulbs; 4) LEDs; 5) Other) including indoor and outdoor lighting	PI	PI	N
		Number of lighting appliances	PI	PI	N
		Fuel type	SI	SI	N
		Control method: 1) Daylight dimming; 2) Occupancy sensors; 3) Manual dimming; 4) Bi-level control; 5) Manual; 6) Part of EMCS; 7) Other	SI	SI	N
		Power density for each activity area	PI	PI	Y
		Total power (w)	PI	PI	N
		Energy efficiency label or not	SI	SI	N
3.4.8	Office appliances	Type(s) of appliances (Select one or more: 1) Computer, including monitor; 2) Server; 3) Copier; 4) Scanner; 5) Telephone/fax; 6) Printer; 7) Teleconference system; 8) Other)	PI	PI	N
		Number of appliances	PI	PI	N
		Fuel type	PI	PI	Y
		Power density for each activity area	PI	PI	Y
		Total power (w)	PI	PI	N
		Energy efficiency label or not	SI	SI	N
		Other performance	SI	SI	N

3.4.9	Other	Types of other equipment used in the building. Select one or more: • Water heating appliances: 1) District hot water; 2) Central hot water system; 3) Hot water at point sources; 4) Other • Kitchen appliances: 1) Oven; 2) Cooktop; 3) Microwave; 4) Coffee maker; 5) Toaster oven; 6) Refrigerator; 7) Separate freezer; 8) Dishwasher; 9) Toaster; 10) Other Other: 1) Elevator; 2) Security monitors; 3) Other	SI	SI	N
		Number of appliances	SI	SI	N
		Fuel type	SI	SI	Y
		Power density for each activity area	SI	SI	Y
		Total power (w)	PI	PI	N
		Water heating: Tank capacity	PI	PI	Y
		Water heating: Energy efficiency	SI	SI	Y
		Water heating: Control method (Select one) 1) Programmable thermostat; 2) Manual thermostat; 3) Other	SI	SI	N
		Water heating: Temperature of supply water	PI	PI	Y
		Energy efficiency label or not	SI	SI	N

3.5 Building operation and occupant behavior

As for the description of building operation and occupant behaviour, there are five ways to describe their characteristics and rules, with several sub-schemes to provide a more specific description.

(1) Schedule: The change of an object's status depends on a certain schedule.
(2) Set point: The occupant changes the status of an object based on a set point.
(3) Control: The occupant changes the status of an object based on a control objective.
(4) Space: The occupant operates an object in either the full space or part space.
(5) Random: The change of objects' status has no certain discipline and runs randomly.

A. Subschema definitions

NOTE: When the definitions include an X, it is recommended to collect data on the specific times, temperature, percentages, level, etc.

3.5.1 **Subschema definitions**

Table 3-19 Item definition of subschema definitions in Level C

Item	Mode	Code	Definition	Parameter Used for Simulation (Y/N/?)
Schedule	Subschema 1: Time mode (for appliances with long daily operation periods)	1.1	Full time or part time (when occupied) in each month or season.	N
		1.2	Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	Y
	Subschema 2: Event mode (for the appliances with short or infrequent operation periods)	2.1	At which time periods for full load; at which time periods for partial load	N
		2.2	Starting time and ending time of this event	Y
	Subschema 3: Load mode	3.1	At which time periods for full load; at which time periods for partial load.	N
		3.2	Fraction of the nominal lighting power (value between 0 and 1) for each hour during business hours, break time, non-business hours (overtime and weekends) and holidays.	Y
		3.3	Fraction of the nominal appliance power (value between 0 and 1) for each hour during business hours, break time, non-business hours (overtime and weekends) and holidays.	Y
	Subschema 4: Portion mode	4.1	Percentage of the objects (fan, shades, lighting, window, etc.) that are opened or used.	Y
		4.2	Fraction of the nominal occupancy (value between 0 and 1) for each hour of the day for offices and meeting rooms.	Y
		4.3	Percentage of shades closed/window opening width for each hour of the day when the building is occupied and unoccupied.	Y

	Subschema 5: Temperature setback mode	5	At what time period when the indoor temperature is setback	N
Set point	Subschema 6: Single point mode	6	Always set at a certain point (x℃) for the indoor temperature or supply temperature for domestic hot water, chilled water set point, heating/cooling coil discharge temperature, etc. (If possible, please indicate the specific indoor temperature setback points when space is unoccupied.)	Y
	Subschema 7: Range mode	7	Usually set the indoor temperature or supply temperature of domestic hot water, chilled water set point, heating/cooling coil discharge temperature, etc. in the range of x(minimum) – y(maximum) (If possible, please indicate the specific temperature setback ranges when not occupied.).	Y
	Subschema 8: Load mode	8	Reset the supply cold/hot air/water temperature based on the actual load so that the valve of the worst-case coil is fully open (For hot water set point, chilled water set point)	Y
	Subschema 9: Outdoor temperature mode	9.1	When the outdoor temperature is higher than x℃, reset the supply cold/hot air/water temperature, and supply temperature of domestic hot water at a certain point (usually a minimum point) or in the range of x℃-x℃ . (For chilled water set point, cold/hot Deck Reset temperatures (cold/heating deck leaving temperature))	Y
		9.2	When the outdoor temperature lower than x℃, reset the cold/hot supply air/water temperature, and supply temperature of domestic hot water at a certain point (usually a maximum point) or in the range of x℃-x℃. (For chilled water set point, cold/hot Deck Reset temperatures (cold/heating deck leaving temperature))	Y
	Subschema 10: Flux mode for hot water	10	A certain amount (x litres per person per day) of water use per person as if it is a set point (This subschema could be used for simulation or calculation).	Y
	Subschema 11: indoor Temperature mode	11.1	When the indoor temperature/humidity higher than x℃, open it.	N
		11.2	When the indoor temperature/humidity lower than x℃, open it.	N
	Subschema	12.1	When there is a certain level of CO_2 or CO, open it.	N

12: Air quality mode	12.2	When there is a certain level of CO_2 or CO, close it.	N
Subschema 13: Frequency mode	13.1	Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	Y
	13.2	Gear limit (For example: high/low speed only)	N
Subschema 14: Illumination mode	14	When the illumination outside is < x lux, open it.	N
Subschema 15: Personnel mode	15	When there are the occupants, open or use it.	N
Subschema 16: Solar irradiation mode	16	When solar irradiation is strong (such as > xJ/(cm2*min)), close it.	N
Subschema 17: On/off mode	17.1	When not in use, turned off (appliances and lighting).	N
	17.2	When not in use, in standby mode (appliances and lighting).	N
	17.3	When not in use, left on (appliances and lighting).	N
Subschema 18: Temperature difference + # of machines running mode	18	When temperature difference is higher than x℃, open one or more machines, etc.	N
Subschema 19: Standby mode	19	The loop is active (i.e., pumps on) whenever any one of the systems served by the loop is running (i.e., fans on). Note that in this mode even if all of the thermostats in all of the zones served by the loop are satisfied (i.e., no load), the loop will be active (i.e., pumps running). (CHW LOOP PUMP CONTROL/hot water system control)	Y

	Subschema 20: Scheduled mode	20	The loop activates according to a user-defined schedule. The default schedule matches the fan schedule, which initially makes this option functionally identical to "Standby." (CHW LOOP PUMP CONTROL/hot water system control)	Y
	Subschema 21: Demand mode	21	The loop is active only when a coil load (i.e., thermostat demand) actually exists. This is the most energy-efficient mode of operation. For example, if an attached system is running, pumps will not activate until there is actually a heating load. (CHW LOOP PUMP CONTROL/hot water system control)	Y
	Subschema 22: Order control of different appliance use mode	22	1. Open the window first, and then use the air conditioner. 2. Use electrical fan, then use the air conditioner.	N
	Subschema 23: Operator mode	23.1	Object controlled by occupants.	N
		23.2	Object controlled by building managers.	N
Space	Subschema 24: Full space mode	24	In the full space.	N
	Subschema 25: Part space mode	25	In part of the space. Indicate the percentage of area or which areas in each zone where the objects are used.	Y
Random	Subschema 26: Random mode	26	The change of object's status has no certain discipline, and runs randomly.	N

B. Building system operation modes, schedule, set point and control

In this part, the above subschemas can be used to describe the operation schedule, set points and control of technical building systems.

3.5.2 Building system operation schedule, set point, control and space

Potential Subschemas and Definitions

Table 3-20 Item definition of business hours in Level C

Business Hours

Item	Potential Subschema	IO	CO

Schedule	Subschema 1.2: Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI	PI
Set Point	N/A		
Control	N/A		
Space	N/A		

Table 3-21 Item definition of occupancy schedule in Level C

Occupancy Schedule

Item	Potential Subschema	IO	CO
Schedule	Subschema 1.2: Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	SI	SI
	Subschema 4.2 Fraction of the nominal occupancy (value between 0 and 1) for each hour of the day for offices and meeting rooms.	PI	PI
	Subschema 26: The change of object's status has no certain discipline, and runs randomly.	SI	SI
Set Point	N/A		
Control	N/A		
Space	Subschema 24: occupied in the full space.	SI	SI
	Subschema 25: occupied in part of the space. Indicate the percentage of area or which areas in each zone are occupied.	SI	SI

Table 3-22 Item definition of the operation of air conditioning (centralized) in Level C

Air Conditioning – Centralized

Object	Item	Potential Subschema	CO
indoor temperature,	Schedule	Subschema 5: At what time period when the indoor temperature is setback	SI
	Set Point	Subschema 6 Always set at a certain point (x℃) for the indoor temperature (If possible, please indicate the specific indoor temperature setback points when space is unoccupied.)	PI
		Subschema 7 Usually set the indoor temperature in the range of x(minimum) – y(maximum) (If possible, please indicate the specific temperature setback ranges when not occupied.).	PI
		Subschema 9.1 When the outdoor temperature is higher than x℃, reset indoor temperature at a certain point (usually a minimum point) or in the range of x℃-x℃ .	SI

		Subschema 9.2 When the outdoor temperature lower than x℃, reset the indoor temperature at a certain point (usually a maximum point) or in the range of x℃-x℃.	SI
	Control	N/A	
	Space	Subschema 24, in full space	PI
		Subschema 25 set in part of the space. Indicate the percentage of area or which areas in each zone where the specific temperature is set.	PI
Heat sources	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2: Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the heat sources that are used.	PI
	Set Point	Subschema 6 (For supply/return temperature of hot water): Always set at a certain point (x℃) for the hot water , etc. (If possible, please indicate the specific indoor temperature setback points when space is unoccupied.)	PI
		Subschema 7 (For supply/return temperature of hot water): Usually set the supply temperature of hot water in the range of x(minimum) – y(maximum) (If possible, please indicate the specific temperature setback ranges when not occupied.).	PI
		Subschema 9.1 When the outdoor temperature is higher than x℃, reset the supply hot water temperature, and supply temperature of domestic hot water at a certain point (usually a minimum point) or in the range of x℃-x℃ .	SI
		Subschema 9.2 When the outdoor temperature lower than x℃, reset the supply hot water temperature at a certain point (usually a maximum point) or in the range of x℃-x℃.	SI
	Control	Subschema 13.1 Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 18 When temperature difference is higher than x℃, open one or more machines, etc.	SI
		Subschema 23.2 Object controlled by building managers.	SI
	Space	N/A	
Cooling sources	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI

		Subschema 4.1 Percentage of the heat sources that are used.	PI
	Set Point	Subschema 6 (For supply/return temperature of chilled water): Always set at a certain point (x℃) for the chilled water/hot water , etc. (If possible, please indicate the specific indoor temperature setback points when space is unoccupied.)	PI
		Subschema 7 (For supply/return temperature of chilled water): Usually set the supply temperature of chilled water in the range of x(minimum) – y(maximum) (If possible, please indicate the specific temperature setback ranges when not occupied.).	PI
		Subschema 9.1 (For supply/return temperature of chilled water): When the outdoor temperature is higher than x℃, reset the supply chilled water temperature, and supply temperature of domestic hot water at a certain point (usually a minimum point) or in the range of x℃-x℃ .	SI
		Subschema 9.2 (For supply/return temperature of chilled water):When the outdoor temperature lower than x℃, reset the supply chilled water temperature at a certain point (usually a maximum point) or in the range of x℃-x℃.	SI
	Control	Subschema 13.1 Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 18 When temperature difference is higher than x℃, open one or more machines, etc.	SI
		Subschema 23.2 Object controlled by building managers.	SI
	Space	N/A	
District space heating/cooling	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
	Set Point	Subschema 6 (For supply/return temperature of hot/cold water): Always set at a certain point (x℃) for the hot/chilled water, etc. (If possible, please indicate the specific indoor temperature setback points when space is unoccupied.)	PI
		Subschema 7 (For supply/return temperature of hot/cold water): Usually set the supply temperature of hot/chilled water in the range of x(minimum) – y(maximum) (If possible, please indicate the specific temperature setback ranges when not occupied.).	PI
		Subschema 9.1 For supply/return temperature of hot/cold water):When the outdoor temperature is higher than x℃, reset the supply hot/chilled water temperature, and supply temperature of domestic hot water at a certain point (usually a minimum point) or in the range of x℃-x℃ .	SI

		Subschema 9.2 For supply/return temperature of hot/cold water): When the outdoor temperature is lower than x℃, reset the supply hot/chilled water temperature at a certain point (usually a maximum point) or in the range of x℃-x℃.	SI
	Control	Subschema 13.1 Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 23.2 Object controlled by building managers	SI
	Space	Subschema 24: supplied in the full space.	SI
		Subschema 25: supplied in part of the space. Indicate the percentage of area or which areas in each zone supplied.	SI
Chilled water pump	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the pumps that are used.	PI
	Control	Subschema 13.1:Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 13.2:Gear limit (For example: high/low speed only)	PI
		Subschema 18: When temperature difference is higher than x℃, open one or more machines, etc.	SI
		Subschema 19: The loop is active (i.e., pumps on) whenever any one of the systems served by the loop is running (i.e., fans on). Note that in this mode even if all of the thermostats in all of the zones served by the loop are satisfied (i.e., no load), the loop will be active (i.e., pumps running). (CHW LOOP PUMP CONTROL/hot water system control)	SI
		Subschema 20: The loop activates according to a user-defined schedule. The default schedule matches the fan schedule, which initially makes this option functionally identical to “Standby.” (CHW LOOP PUMP CONTROL/hot water system control)	SI
		Subschema 21:The loop is active only when a coil load (i.e., thermostat demand) actually exists. This is the most energy-efficient mode of operation. For example, if an attached system is running, pumps will not activate until there is actually a heating load. (CHW LOOP PUMP CONTROL/hot water system control)	SI
		Subschema 23.2 Object controlled by building managers.	SI
	Space	N/A	
Cooling water	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI

pump		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the pumps that are used.	PI
	Control	Subschema 13.1:Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 13.2:Gear limit (For example: high/low speed only)	PI
		Subschema18: When temperature difference is higher than x℃, open one or more machines, etc.	SI
		Subschema 19: The loop is active (i.e., pumps on) whenever any one of the systems served by the loop is running (i.e., fans on). Note that in this mode even if all of the thermostats in all of the zones served by the loop are satisfied (i.e., no load), the loop will be active (i.e., pumps running). (CHW LOOP PUMP CONTROL/hot water system control)	SI
		Subschema 20: The loop activates according to a user-defined schedule. The default schedule matches the fan schedule, which initially makes this option functionally identical to "Standby." (CHW LOOP PUMP CONTROL/hot water system control)	SI
		Subschema 21:The loop is active only when a coil load (i.e., thermostat demand) actually exists. This is the most energy-efficient mode of operation. For example, if an attached system is running, pumps will not activate until there is actually a heating load. (CHW LOOP PUMP CONTROL/hot water system control)	SI
		Subschema 23.2 Object controlled by building managers.	SI
	Space	N/A	
AHU fan	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the fans that are used.	PI
	Set Point	Subschema 6: Usually set the supply cold/hot air temperature at a specific point (If possible, please indicate the specific temperature setback point when not occupied.).	PI
		Subschema 7: Usually set the supply cold/hot air temperature in the range of x℃-x℃ (If possible, please indicate the specific temperature setback ranges when not occupied.).	PI

		Subschema 8: Reset the supply cold/hot air temperature based on the actual load so that the valve of the worst-case coil is fully open.	SI
		Subschema 9.1: When the outdoor temperature is higher than x℃, reset the supply cold/hot air at a certain point (usually a minimum point) or in the range of x℃-x℃ . (For cold/hot Deck Reset temperatures (cold/heating deck leaving temperature))	SI
		Subschema 9.2: When the outdoor temperature is lower than x℃, reset the cold/hot supply air temperature at a certain point (usually a maximum point) or in the range of x℃-x℃. (For cold/hot Deck Reset temperatures (cold/heating deck leaving temperature))	SI
	Control	Subschema 13.1:Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 13.2:Gear limit (For example: high/low speed only)	PI
		Subschema 23.1 Object controlled by occupants.	SI
		Subschema 23.2 Object controlled by building managers.	SI
	Space	Subschema 24: supplied in the full space.	PI
		Subschema 25: supplied in part of the space. Indicate the percentage of area or which areas in each zone supplied.	PI
FCU fan	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the fans that are opened or used.	PI
	Set Point	Subschema 6: Usually set the supply cold/hot air temperature at a specific point (If possible, please indicate the specific temperature setback points when not occupied.).	PI
		Subschema 7: Usually set the supply cold/hot air temperature in the range of x℃-x℃ (If possible, please indicate the specific temperature setback ranges when not occupied.).	PI
		Subschema 8: Reset the supply cold/hot air temperature based on the actual load so that the valve of the worst-case coil is fully open.	SI
		Subschema 9.1: When the outdoor temperature is higher than x℃, reset the supply cold/hot air at a certain point (usually a minimum point) or in the range of x℃-x℃ . (For cold/hot Deck Reset temperatures (cold/heating deck leaving temperature))	SI
		Subschema 9.2: When the outdoor temperature lower than x℃, reset the cold/hot supply air temperature at a certain point (usually a maximum point) or in the range of x℃-x℃. (For cold/hot Deck Reset temperatures (cold/heating deck leaving temperature))	SI

	Control	Subschema 13.1:Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 13.2:Gear limit (For example: high/low speed only)	PI
		Subschema 23.1 Object controlled by occupants.	SI
		Subschema 23.2 Object controlled by building managers.	SI
	Space	Subschema 24: supplied in the full space.	PI
		Subschema 25: supplied in part of the space. Indicate the percentage of area or which areas in each zone supplied.	PI
Cooling tower	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the cooling towers that are opened or used.	PI
	Control	Subschema 18 When temperature difference is higher than x℃, open one or more machines, etc.	SI
		Subschema 23.2 Object controlled by building managers.	SI
	Space	N/A	
Pumps for cooling storage systems	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the pumps that are opened or used.	PI
	Set Point	N/A	
	Control	Subschema 13.1:Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 13.2:Gear limit (For example: high/low speed only)	PI
		Subschema 23.1 Object controlled by occupants.	SI
	Space	N/A	
Heat exchanger	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI

		Subschema 4.1 Percentage of the heat exchangers that are opened or used.	PI
	Control	Subschema 13.1:Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 13.2:Gear limit (For example: high/low speed only)	PI
		Subschema 23.1 Object controlled by occupants.	SI
	Space	N/A	
Radiator/ Floor/wall/ceiling radiative systems	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the radiative system that is opened or used.	SI
	Set Point	Subschema 6: Usually set the supply cold/hot air temperature at a specific point (If possible, please indicate the specific temperature setback point when not occupied.).	PI
		Subschema 7: Usually set the supply cold/hot air temperature in the range of x℃-x℃ (If possible, please indicate the specific temperature setback ranges when not occupied.).	PI
		Subschema 9.1: When the outdoor temperature is higher than x℃, reset the supply cold/hot air at a certain point (usually a minimum point) or in the range of x℃-x℃ . (For cold/hot Deck Reset temperatures (cold/heating deck leaving temperature))	SI
		Subschema 9.2: When the outdoor temperature lower than x℃, reset the cold/hot supply air temperature at a certain point (usually a maximum point) or in the range of x℃-x℃. (For cold/hot Deck Reset temperatures (cold/heating deck leaving temperature))	SI
	Control	Subschema 23.1 (For personal space) Object controlled by occupants.	SI
	Space	Subschema 24: supplied in the full space.	PI
		Subschema 25: supplied in part of the space. Indicate the percentage of area or which areas in each zone supplied.	PI
Economizer	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the economizers that is opened or used.	PI

	Control	Subschema 23.2 Object controlled by building managers	SI
	Space	N/A	

Table 3-23 Item definition of the operation of space heating (centralized) in Level C

Space Heating – Centralized

Item	Potential Subschema		IO
Heat sources	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2: Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the heat sources that are used.	SI
	Set Point	Subschema 6 (For supply/return temperature of hot water): Always set at a certain point (x℃) for the hot water , etc. (If possible, please indicate the specific indoor temperature setback points when space is unoccupied.)	PI
		Subschema 7 (For supply/return temperature of hot water): Usually set the supply temperature of hot water in the range of x(minimum) – y(maximum) (If possible, please indicate the specific temperature setback ranges when not occupied.).	PI
		Subschema 9.1 When the outdoor temperature is higher than x℃, reset the supply hot water temperature, and supply temperature of domestic hot water at a certain point (usually a minimum point) or in the range of x℃-x℃ .	SI
		Subschema 9.2 When the outdoor temperature lower than x℃, reset the supply hot water temperature at a certain point (usually a maximum point) or in the range of x℃-x℃.	SI
		Subschema 13.1 Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 18 When temperature difference is higher than x℃, open one or more machines, etc.	SI
		Subschema 23.2 Object controlled by building managers.	SI
	Space	N/A	
Hot water pump	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the pumps that are used.	PI

	Control	Subschema 13.1:Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 13.2:Gear limit (For example: high/low speed only)	PI
		Subschema 18: When temperature difference is higher than x℃, open one or more machines, etc.	SI
		Subschema 19: The loop is active (i.e., pumps on) whenever any one of the systems served by the loop is running (i.e., fans on). Note that in this mode even if all of the thermostats in all of the zones served by the loop are satisfied (i.e., no load), the loop will be active (i.e., pumps running). (CHW LOOP PUMP CONTROL/hot water system control)	SI
		Subschema 20: The loop activates according to a user-defined schedule. The default schedule matches the fan schedule, which initially makes this option functionally identical to "Standby." (CHW LOOP PUMP CONTROL/hot water system control)	SI
		Subschema 21:The loop is active only when a coil load (i.e., thermostat demand) actually exists. This is the most energy-efficient mode of operation. For example, if an attached system is running, pumps will not activate until there is actually a heating load. (CHW LOOP PUMP CONTROL/hot water system control)	SI
		Subschema 23.2 Object controlled by building managers.	SI
	Space	N/A	
Heat exchanger	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the heat exchangers that are opened or used.	PI
	Control	Subschema 13.1:Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	PI
		Subschema 13.2:Gear limit (For example: high/low speed only)	PI
		Subschema 23.1 Object controlled by occupants.	SI
	Space	N/A	
Radiator/ Floor/wall/ceiling radiative systems	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI

		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the radiative system that is opened or used.	SI
	Set Point	Subschema 6: Usually set the supply cold/hot air temperature at a specific point (If possible, please indicate the specific temperature setback point when not occupied.).	PI
		Subschema 7: Usually set the supply cold/hot air temperature in the range of x℃-x℃ (If possible, please indicate the specific temperature setback ranges when not occupied.).	PI
		Subschema 9.1: When the outdoor temperature is higher than x℃, reset the supply cold/hot air at a certain point (usually a minimum point) or in the range of x℃-x℃ . (For cold/hot Deck Reset temperatures (cold/heating deck leaving temperature))	SI
		Subschema 9.2: When the outdoor temperature lower than x℃, reset the cold/hot supply air temperature at a certain point (usually a maximum point) or in the range of x℃-x℃. (For cold/hot Deck Reset temperatures (cold/heating deck leaving temperature))	SI
	Control	Subschema 23.1 (For personal space) Object controlled by occupants.	SI
	Space	Subschema 24: supplied in the full space.	PI
		Subschema 25: supplied in part of the space. Indicate the percentage of area or which areas in each zone supplied.	PI
Economizer	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
		Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
		Subschema 4.1 Percentage of the economizers that is opened or used.	PI
	Control	Subschema 23.2 Object controlled by building managers	SI
	Space	N/A	

Table 3-24 Item definition of the operation of space heating (decentralized) in Level C

Space Heating – Decentralized

Item	Potential Subschema	IO
Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI

	Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
	Subschema 4.1 Percentage of the space heaters that are used.	SI
Set Point	Subschema 6 Always set at a certain point (x℃) for the indoor temperature (If possible, please indicate the specific indoor temperature setback points when space is unoccupied.)	PI
	Subschema 7 Usually set the indoor temperature in the range of x(minimum) – y(maximum) (If possible, please indicate the specific temperature setback ranges when not occupied.).	PI
	Subschema 9.1 When the outdoor temperature is higher than x℃, reset indoor temperature at a certain point (usually a minimum point) or in the range of x℃-x℃ .	SI
	Subschema 9.2 When the outdoor temperature lower than x℃, reset the indoor temperature at a certain point (usually a maximum point) or in the range of x℃-x℃.	SI
Control	Subschema 13.2:Gear limit (For example: high/low power only)	PI
	Subschema 23.1: Object controlled by occupants	SI
Space	Subschema 24: supplied in the full space.	PI
	Subschema 25: supplied in part of the space. Indicate the percentage of area or which areas in each zone supplied.	PI

Table 3-25 Item definition of the operation of air conditioning (decentralized) in Level C

Air Conditioning – Decentralized

Item	Potential Subschema	IO
Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
	Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI
	Subschema 4.1 Percentage of AC that are used.	PI
Set Point	Subschema 6 Always set at a certain point (x℃) for the indoor temperature (If possible, please indicate the specific indoor temperature setback points when space is unoccupied.)	PI
	Subschema 7 Usually set the indoor temperature in the range of x(minimum) – y(maximum) (If possible, please indicate the specific temperature setback ranges when not occupied.).	PI
	Subschema 9.1 When the outdoor temperature is higher than x℃, reset indoor temperature at a certain point (usually a minimum point) or in the range of x℃-x℃ .	SI

	Subschema 9.2 When the outdoor temperature lower than x℃, reset the indoor temperature at a certain point (usually a maximum point) or in the range of x℃-x℃.	SI
Control	Subschema 22 1. Open the window first, and then use the air conditioner. 2. Use electrical fan, then use the air conditioner.	SI
	Subschema 23.1 Object controlled by occupants	
Space	Subschema 24: supplied in the full space.	PI
	Subschema 25: supplied in part of the space. Indicate the percentage of area or which areas in each zone supplied.	PI

Table 3-26 Item definition of the operation of ventilation system in Level C

Ventilation (mechanic) – Centralized/Decentralized

Item	Potential Subschema	IO	CO
Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI	PI
	Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI	PI
	Subschema 4.1 Percentage of fans that are used.	PI	PI
Set Point	N/A		
Control	Subschema 11.1: When the indoor temperature/humidity higher than x℃, open it.	SI	SI
	Subschema 11.2:When the indoor temperature/humidity lower than x℃, open it.	SI	SI
	Subschema 12.1:When there is a certain level of CO_2 or CO, open it.	SI	SI
	Subschema 12.2: When there is a certain level of CO_2 or CO, close it.	SI	SI
	Subschema 13.1:Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Subschema	PI	PI
	Subschema 13.2:Gear limit (For example: high/low speed only)	PI	PI
	Subschema 23.1:Object controlled by occupants.	SI	n/a
	Subschema 23.2:Object controlled by building managers.	n/a	SI
Space	Subschema 24: supplied in the full space.	PI	PI
	Subschema 25: supplied in part of the space. Indicate the percentage of area or which areas in each zone supplied.	PI	PI

Table 3-27 Item definition of the operation of lighting in Level C

Lighting

Item	Potential Subschema	IO	CO

Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI	PI
	Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI	PI
	Subschema 4.1 Percentage of lights that are used.	PI	PI
	Subschema 3.2 Fraction of the nominal lighting power (value between 0 and 1) for each hour during business hours, break time, non-business hours (overtime and weekends) and holidays.	PI	PI
	Subschema 26 The change of object's status has no certain discipline, and runs randomly.	SI	SI
Set Point	N/A		
Control	Subschema 14:When the illumination outside is < x lux, open it.	SI	SI
	Subschema 15:When there are the occupants, open or use it.	SI	SI
	Subschema 17.1: When not in use, turned off (appliances and lighting).	SI	SI
	Subschema 17.3:When not in use, left on (appliances and lighting).	SI	SI
	Subschema 23.1 (For personal space)Object controlled by occupants.	SI	SI
	Subschema 23.2(For public space):Object controlled by building managers.	SI	SI
Space	Subschema 24: supplied in the full space.	PI	PI
	Subschema 25: supplied in part of the space. Indicate the percentage of area or which areas in each zone supplied.	PI	PI

Table 3-28 Item definition of the operation of office appliances in Level C

Office appliances

Item	Potential Subschema	IO	CO
Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI	PI
	Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI	PI
	Subschema 4.1 Percentage of appliances that are used.	PI	PI
	Subschema 3.3 Fraction of the nominal appliance power (value between 0 and 1) for each hour during business hours, break time, non-business hours (overtime and weekends) and holidays.	PI	PI
Set Point	N/A		
Control	Subschema 15:When there are the occupants, open or use it.	SI	SI
	Subschema 17.1: When not in use, turned off	SI	SI
	Subschema 17.2: When not in use, in standby mode	SI	SI
	Subschema 17.3:When not in use, left on	SI	SI
	Subschema 23.1 (For personal space) Object controlled by occupants.	SI	SI

	Subschema 23.2(For public space):Object controlled by building managers.	SI	SI

Table 3-29 Item definition of the operation of other appliances in Level C

Other

Item	Potential Subschema	IO	CO
Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI	PI
	Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI	PI
	Subschema 3.3 Fraction of the nominal appliance power (value between 0 and 1) for each hour during business hours, break time, non-business hours (overtime and weekends) and holidays.	PI	PI
Set Point	N/A		
	Subschema 10 (For hot water use): A certain amount (x litres per person per day) of water use per person as if it is a set point (This subschema could be used for simulation or calculation).	PI	PI
Control	Subschema 15:When there are the occupants, open or use it.	SI	SI
	Subschema 17.1: When not in use, turned off	SI	SI
	Subschema 17.2: When not in use, in standby mode	SI	SI
	Subschema 17.3:When not in use, left on	SI	SI
	Subschema 23.1 (For personal space) Object controlled by occupants.	SI	SI
	Subschema 23.2(For public space): Object controlled by building managers.	SI	SI
Space	Subschema 24: supplied in the full space.	PI	PI
	Subschema 25: supplied in part of the space. Indicate the percentage of area or which areas in each zone supplied.	PI	PI

Table 3-30 Item definition of the occupant behaviour of window opening in Level C

Windows

Item	Potential Subschema	IO	CO
Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI	PI
	Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI	PI
	Subschema 4.1: Percentage of the windows that are opened.	PI	PI
	Subschema 4.3: Percentage of window opening width for each hour of the day when the building is occupied and unoccupied.	PI	PI
	Subschema 26 The change of object's status has no certain discipline, and runs randomly.	SI	SI
Set Point	N/A		

Control	Subschema 11.1: When the indoor temperature/humidity higher than x℃, open it.	SI	SI
	Subschema 11.2:When the indoor temperature/humidity lower than x℃, open it.	SI	SI
	Subschema 12.1: When there is a certain level of CO_2 or CO, open it.	SI	SI
	Subschema 12.1: When there is a certain level of CO_2 or CO, close it.	SI	SI
	Subschema 22: 1. Open the window first, and then use the air conditioner. 2. Use electrical fan, then use the air conditioner.	SI	SI
	Subschema 23.1 (For personal space)Object controlled by occupants.	SI	SI
	Subschema 23.2(For public space):Object controlled by building managers.	SI	SI

Table 3-31 Item definition of the occupant behaviour of curtain/blinds use in Level C

Curtains/blinds

Item	Potential Subschema	IO	CO
Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI	PI
	Subschema 1.2 Number of weeks or from week A to week B in each month, number of months or from month A to month B in each season, and one time period (from time A to time B) or several time periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.	PI	PI
	Subschema 4.3 Percentage of shades closed width for each hour of the day when the building is occupied and unoccupied.	PI	PI
	Subschema 26 The change of object's status has no certain discipline, and runs randomly.	SI	SI
Set Point	N/A		
Control	Subschema 14: When the illumination outside is < x lux, open it.	SI	SI
	Subschema 16: When solar irradiation is strong (such as > xJ/(cm2*min)), close it.	SI	SI
	Subschema 23.1 (For personal space) Object controlled by occupants.	SI	SI

Building operation and occupants' behavior is an important research topic in this Annex. Based on the definitions of building operation and occupants behavior above, other subtasks make further research combined with their own research objects, such as making more detailed definitions, making the classifications of different occupants behavior, and developing the methodology to use the above definitions to describe the behavior in office buildings. For more information, please refer to the documents developed by other subtasks.

3.6 Input into energy performance indicators

Building energy use can be expressed in the three ways according to attachment 3, which are

(1) Energy use of each energy resource, fuel, electricity, cooling and heating, and peak electric demand

(2) Aggregation of energy of primary energy, equivalent electricity, and equivalent CO2 emissions

(3) Normalized energy use in the above two approaches

Table 3-32 Item definition of energy performance indicators in Level C

Code	Item		Definition	Frequency	Scope	IO	CO
3.6.1	Step 1: Energy Carrier	Fuel consumption	Indicate fuel consumption in J, MJ, or GJ	Hourly or monthly plus daily for typical weeks each season	For each business or whole building Also available for each end use	PI	PI
3.6.2		Electricity consumption	Indicate electricity consumption in J, MJ or GJ	Hourly or monthly plus daily for typical weeks each season	For each business or whole building Also available for each end use	PI	PI
3.6.3		Cooling consumption	Indicate cooling consumption in J, MJ or GJ	Hourly or monthly plus daily for typical weeks each season	For each zone or whole building	SI	SI
3.6.4		Heating consumption	Indicate heating consumption in J, MJ or GJ	Hourly or monthly plus daily for typical weeks each season	For each zone or whole building	SI	SI
3.6.5		Peak electric demand	Indicate peak electric demand in W or kW	Hourly or monthly plus daily for typical weeks each season	N/A	SI	SI
3.6.6	Step 2: Aggregation of Energy		Provide the aggregation of primary energy and equivalent electricity by the methodology provided in I-1	Hourly or monthly plus daily for typical weeks each season	For each business or whole building Also available for each end use	PI	PI
3.6.7	Step 3: Normalized Energy Use	Factors related to energy performance indicators	Normalized energy use	Hourly or monthly plus daily for typical weeks each season	For each business or whole building Also available for each end use	PI	PI

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