

# Definition of terms Separate Document Volume I

## 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;

- Et: Energy delivered to the technical systems in a building;
- E<sub>d</sub>: 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<sub>b</sub>: Energy actually required (namely net energy need) within the building space for space heating, cooling, and domestic hot water in a building;
- E<sub>t</sub>: Energy delivered to the technical systems in a building;
- E<sub>d</sub>: 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<sub>b</sub>: 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.

 $\mathbf{E}_t$  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.

Et 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.

End uses	Heating	Cooling	Hot water
Energy boundary	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
of E <sub>b</sub>	Includes sensible & latent heat	Includes sensible & latent heat	Includes heat recovery

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

	Includes heat for fresh air I through infiltration		Includes cooling for fresh air through infiltration			
	Includes heating for outdoor air handling		Includes cooling for outdoor air handling			
	Includes heat preheat the air	recovered to input	Includes cool to lower the he	Includes cooling recovered to lower the heat input		
	Energy to inlet of technical systems	District heating system: heat delivered to the inlet of building	Energy to inlet of technical systems	District cooling system: cold delivered to the inlet of building	Energy delivered to the domestic hot water system	District heating system: the heat delivered to the building
	Include e distribution transportation	nergy for and in the building	Include e distribution transportation	nergy for and in the building	Include e distribution transportation	energy for and in the building
Energy boundary of E <sub>t</sub>	Include energy loss in energy generation devices and in transportation process	Include energy loss in transportation process in the building	Include energy loss in energy generation devices and in transportation process	Include energy loss in transportation process in the building	Include energy loss in energy generation devices and in transportation process	Include energy loss in transportation process in the building
	Include energy for humidification		Include energy for dehumidification			
	Include energy recovery devic	v used by heat es	Include energy used by heat recovery devices			
	Energy consumed by the central plant for space heating		Energy consumed by the central plant for space cooling		Energy consu central plant heating. NOTE: If heat by building	to the second se
Energy boundary			cooling		renewable sources, $E_t$ counts only the auxiliary devices.	
of E <sub>d</sub>	Include energy for space heating	for energy gen ng, cooling and	eration systems hot water respe	and all auxilian	ry devices in ce	ntral plant side
	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.					

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
		econing	218.111.8	1 pp nui e e s	services
Energy boundary of E <sub>t</sub>	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	Energy input to cooking appliances	Energy input to lighting appliances	Energy input to appliances providing services	Energy input to other appliances providing other services
	during ventilation.				

#### 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.  $1 \text{ m}^3$  (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.

Energy	Amount	Calorific value Primary energy approach approach		Electricity equivalent approach		
Carriers		MJc	MJp	MJee	Temperature	
Natural Cas	1 m <sup>3</sup>	35.81 <sup>a</sup>	35.81 <sup>a</sup>	23.60 <sup>a</sup>	СТ: 1773К	
Natural Gas	1 111	(33.82~37.80)	(33.82~37.80)	(22.29~24.91)	Ref. T: 273K	
Crude Oil	1 ka	43.56 <sup>a</sup>	43.56 <sup>a</sup>	28.71 <sup>a</sup>	СТ: 1773К	
Ciude Oli	i kg	(41.87~45.26)	(41.87~45.26)	(27.59~29.83)	Ref. T: 273K	
Coal	1 kg	23.66 <sup>a</sup>	23.66 <sup>a</sup>	11.92 <sup>a</sup>	CT: 973K	
Coal	1 Kg	(18.46~28.85)	(18.46~28.85)	(9.30~14.54)	Ref. T: 273K	
Liquefied	1.1	47.08 <sup>b</sup>	47.08 <sup>b</sup>	31.02 <sup>b</sup>	CT: 1773K	
gas	l kg	(46.01~47.69)	(46.01 ~47.69)	(30.32~31.43)	Ref. T: 273K	
Motor	1 1 1	44.55 <sup>b</sup>	44.55 <sup>b</sup>	29.36 <sup>b</sup>	СТ: 1773К	
Gasoline	1 Kg	(44.00~44.80)	(44.00 ~44.80)	(29.00~29.52)	Ref. T: 273K	
Varagana	1 1 1	43.38 <sup>b</sup>	43.38 <sup>b</sup>	28.59 <sup>b</sup>	СТ: 1773К	
Kelöselle	1 Kg	(42.92~43.79)	(42.92~43.79)	(28.28~28.86)	Ref. T: 273K	
Gas/diesel	1 ka	42.76 <sup>b</sup>	42.76 <sup>b</sup>	28.18 <sup>b</sup>	СТ: 1773К	
oil	1 Kg	(42.58~43.29)	(42.58~43.29)	(28.06~28.53)	Ref. T: 273K	
Fuel oil	1 kg	40.74 <sup>b</sup>	40.74 <sup>b</sup>	26.85 <sup>b</sup>	СТ: 1773К	
Fuelon	1 Kg	(39.98~42.58)	(39.98~42.58)	(26.35~28.06)	Ref. T: 273K	
Hot Water (95°C/70°C)	1 MJ	1	1	0.2317	Ref. T: 273 K	

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

Hot Water (50°C/40°C)	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 (7°C/12°C)	1 MJ	1	1	0.07256	Ref. T: 303 K
Electricity	1 kWh	3.6	10.91 c	3.6	
a) Average va	alue of the	selected country-spe	ecific net calorific va	alues, with minimu	n and maximum
values in the	bracket. So	urce: Key World En	ergy Statistics, Inter	national Energy Ag	ency, 2010;
b) Average v	alue of the	default net calorifi	c values of oil prod	ucts, with minimur	n 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: Refer	ence Temp	erature			

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.

Name of parameter	Original Unit	Standard unit
a) Fuel Consumption	m <sup>3</sup> 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

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

#### 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)

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Table	1-4 energi	/ Deriormance	<i>י וממוכמוסי</i> ר	TOP SIPD /	. OI (I	<i>oorponnon (</i>	n energy
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Name of parameter	Units
a) Primary Energy (Ep)	MJ, GJ
b) Equivalent electricity (Eee)	kWh <sub>ee</sub>

#### 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.

	1 00
Indices used for normalization	Form
a) Geometrical factors where Sn $[m^2] =$	1) For electricity consumption= $kWh/m^2$ , per
floor area and Sw $[m^2]$ = conditioned	year or month
floor area	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 $= GJ/DDh m^2$

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

#### 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.

End Use	E <sub>d</sub>	Et	E <sub>b</sub>	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	Х	Х
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	х	Х
3) Energy for ventilatio n	N/A	Energy for ventilation	N/A	Х	Х
4) Energy for lighting	N/A	Energy for lighting	N/A	Х	Х
5) Energy for domestic or office appliances	N/A	Energy for domestic/office appliances	N/A	Х	Х
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	Х	N/A
7) Energy for other appliances	N/A	Energy for other appliances, such as elevators/escalators, security monitors, etc.		Х	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	Х

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

# I-2

Three level data typologies for residential buildings

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#### 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	Indicate the heating degree days and cooling	Monthly or	PI	PI
	CDD		degree days and the reference temperatures used.	annual		

#### 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	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	<ul> <li>This includes walls, ceiling, floor, and window material.</li> <li>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</li> <li>Walls insulated (Y/N?)</li> <li>Roof material (select one): 1) Brick 2) Concrete; 3) Concrete panels; 4) Stone; 5) Wood; 6) Other</li> <li>Roof insulated (Y/N?)</li> <li>Window material <ul> <li>Select one frame type: 1) Aluminium, 2) Plastic steel; 3) Steel, 4) Wood; 5) Other</li> <li>Select number of panes: 1) Single; 2) Double; 3) Triple; 4) Other</li> <li>Select one glass type: 1) Flat glass; 2) Insulating glass; 3) Insulating glass-AR; 4) Insulating glass-KR; 5) Low</li> <li>e; 6) Solar protection glass; 7) Other</li> </ul> </li> <li>Select the percentage of operable windows: 1) Not operable; 2) Less than 10%; 3) 10%-30%; 4) 30%-60%; 5) More than 60%</li> </ul>	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.

Code	Item	Definition	Definition				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	<ul> <li>Types of lighting (Select one or more: 1) Incandescent bulbs;</li> <li>2) Fluorescent bulbs;</li> <li>3) Compact fluorescent bulbs; 4) LEDs; 5) Other)</li> </ul>		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

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

1.4.0			<b>F</b> 1	TT / 1	DI	DI
1.4.8	Domestic hot	Type of decentralized hot water	Fuel	Total	PI	PI
	water -	system	type	power		
	decentralized			(w)		
1.4.9	Cooking	Type(s) of appliances used for	Fuel	Total	SI	SI
	_	cooking (Select one or more: 1)	type	power		
		Oven; 2) Cooktop;	51	(w)		
		3) Microwave; 4) Coffee maker;				
		5) Toaster oven;				
		6) Refrigerator; 7) Separate				
		freezer: 8) Dishwasher: 9)				
		Toaster: 10) Other)				
1 4 10	Domestic	Type(s) of appliances		Total	SI	SI
1.1.10	annliances	• Entertainment – Select or		nower	51	51
	appliances	more: 1) TV: 2)		$(\mathbf{w})$		
		$V(\mathbf{P}/\mathbf{D}\mathbf{V}\mathbf{D}; 2)$ Stored		(w)		
		VCR/DVD, 3) Steleo				
		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				
1.4 11	Other	Types of other equipment used in	Fuel	Total	N/	SI
11		the building (Select one or more)	type	nower	A	~
		1) Elevator: 2) Security monitors:	cype	(w)	11	
		3) Other)		(")		
1		( ) ( ) ( ) ( )	1	1		

#### 1.5 **Building operation**

Use occupancy schedule to describe building operation.

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

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

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

#### 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.

Code	Category	Parameter	Description	SF	MF
1.7.1	Family factors	Income per household/perso n	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	Subjectiveassessmentofconsciousnessof occupants of energyconservation:1)Veryconcerned;2)Concerned;3)Indifferent;4)Notsoconcerned;5)Notconcerned 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

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

#### 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.

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

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

#### 2.2 Whole building characteristics

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

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

2.2.5	Number of	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	<ul> <li>This includes walls, ceiling, floor, and window material.</li> <li>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</li> <li>Wall insulation material: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Batt; 5) Fiberboard sheathing; 6) Rockwool; 7) Other; 8) No insulation</li> <li>Roof material (select one): 1) Brick 2) Concrete; 3) Concrete panels; 4) Stone; 5) Wood; 6) Other</li> <li>Roof insulation material: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Batt; 5) Fiberglass; 6) Rockwool; 7) Others; 8) No insulation</li> <li>Attic insulation material: 1) Fiberglass; 2) Rockwool; 3) Insulsafe; 4) Recycled cotton; 5) ISOCY; 6) Icynene; 7)</li> </ul>	PI	PI

		<ul> <li>Unknown insulation; 8) Other; 9) No insulation</li> <li>Floor material (select one): 1) Brick; 2) Concrete; 3) Stone; 4) Stucco; 5) Other</li> <li>Floor insulation material: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Other; 5) No insulation</li> <li>Window material <ul> <li>Select one frame type: 1) Aluminum, 2) Plastic steel;</li> <li>3) Steel, 4) Wood; 5) Other</li> <li>Select number of panes: 1) Single; 2) Double; 3) Triple; 4) Other</li> <li>Select one glass type: 1) Flat glass; 2) Insulating glass; 3) Insulating glass-AR; 4) Insulating glass-KR; 5) Low-e; 6) Other</li> </ul> </li> <li>Select the percentage of operable windows: 1) Not operable; 2) Less than 10%; 3) 10%-30%; 4) 30%-60%; 5) More than 60%</li> <li>Shading system <ul> <li>Select one or more: 1) External overhangs; 2) Awnings; 3) Solar screens; 4) Solar film; 5) Other</li> </ul> </li> </ul>		
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	Definition					
2.4.1	Space	Type of space heating		Fuel	Total	Heat	PI	PI
	heating -	system (Select one: 1)		type	power	capacity of		
	centralized	District steam hot			(w)	the building		

		water; 2) Boilers inside the building; 3) Other)				(w)		
2.4.2	Space heating - decentraliz ed	Type of space heating system (Select one or more: 1) Individual space heaters; 2) Furnaces; 3) Other)	Numb er of each type of heater	Fuel type	Total power (w)	Heat capacity (w)	PI	PI
2.4.3	Air conditioni ng - 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 conditioni ng - decentraliz ed	Type of space cooling system (Select one or more: 1) Individual room A/C; 2) Other)	Numb er of each type of equip.	Fuel type	Total power (w)	Heat/ cooling capacity (w)	PI	PI
2.4.5	Ventilatio n	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)	Numb er of bulbs		Total power (w)	Control method for common areas (photo/occu pancy/sche duling)	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 capacit y of the bldg. (w)	Control method (manual or automatic)	PI	PI
2.4.8	Domestic hot water - decentraliz ed	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

		<ol> <li>Oven;</li> <li>Cooktop;</li> <li>Microwave;</li> <li>Coffee maker;</li> <li>Toaster oven;</li> <li>Refrigerator;</li> <li>Separate freezer; 8)</li> <li>Dishwasher;</li> <li>Toaster;</li> <li>Other)</li> </ol>					
2.4.1	Domestic	Type(s) of appliances		Total	Energ	PI	PI
0	appliances	Entertainment - Select		power	у		
		one or more: 1) TV; 2)		(w)	efficie		
		VCR/DVD; 3) Stereo			nt		
		system; 4) Computer &			produc		
		related electronics; 5)			t or		
		Telephone/fax; 6)			not		
		Printer/scanner; /)					
		doviace: 8) Other					
		Housework and health					
		- Select one or more: 1)					
		Clothes washer 2)					
		Clothes dryer: 3) Iron:					
		$\begin{array}{c} 4)  \text{Vacuum;}  5) \end{array}$					
		Dehumidifier					
		/humidifier; 6) Other					
2.4.1	Other	Types of other	Fuel	Total		N/	SI
1		equipment used in the	type	power		А	
		building (Select one or		(w)			
		more: 1) Elevator; 2)					
		Security monitors; 3)					
		Other)					

#### 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	Schedule	Set point	SF	MF
		mode						

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

#### 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	M F
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.	Providethefollowing:1)# ofweeksusedinsummerandwinter;2)Whenused,# ofhoursatatnight/daytimeonweekday/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	Providethefollowing:1)Number of times fanusedonweekday/weekend;2) Minutes per use.	N/A	PI	PI
2.5.4	Ventilation (mechanic) - Basement/g arage	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.	Providethefollowing:1)Numberoftimesventilationsystemusedperday;2)Minutes(singlefamily)orhours(multi-family)peruse;3)Portionofappliancesrunning(multi-family only).	Power level used (multi-family only)	PI	PI

255	Lighting	Salast and of the	Drazvida tha	NT/A	DI	ы
2.3.3	Lignting	Select one of the	Provide the	N/A	PI	PI
		following modes: 1)	following: 1) Range			
		Full space, full time;	of running hours; 2)			
		2) Full space, only	Number of lights on			
		occupied time; 3)	when occupied and			
		Only occupied space,	unoccupied.			
		full time; 4) Only				
		occupied space, only				
		occupied time.				
2.5.6	Cooking	N/A	Provide the	N/A	PI	PI
			following: 1) Hours			
			per weekday and			
			weekend; or 2) # of			
			times per			
			day/week/month and			
			minutes per use.			
2.5.7	Domestic	Select one of the	Provided the	Temperature at	PI	PI
	hot water	following for time	following: 1) Hours	which hot water is		
		mode: 1) Water	per dav/week in each	maintained.		
		heating is turned on	season, and litres per			
		full time or part time	hour 2) Times of use			
		(only when at home)	per week and			
			minutes per			
			session/litres per use			
2.5.8	Domestic	N/A	Provide the	N/A	ΡI	Ы
	appliances	- 0	following: 1) Hours	1.012		
	uppliances		ner weekday and			
			weekend: or 2) $\#$ of			
			times per			
			day/week/month and			
			minutes per use			
2.5.9	Other	N/A	Provide the	N/A	N/	SI
			following: 1) Range		A	~
			of running hours: 2)			
			Portion of appliances			
			running weekday and			
			weekend			
2.5.6 2.5.7 2.5.8 2.5.9	Cooking Domestic hot water Domestic appliances Other	full time; 4) Only occupied space, only occupied time. N/A Select one of the following for time mode: 1) Water heating is turned on full time or part time (only when at home). N/A N/A	Providethe following: 1) Hours perperweekdayand weekend; or 2) # of timesperday/week/monthand minutes per use.Providedthe following: 1) Hours per day/week in each season, and litres per hour. 2) Times of use per week and minutesProvidethe following: 1) Hours per day/week in each season, and litres per hour. 2) Times of use per week and minutesProvidethe following: 1) Hours per weekday and weekend; or 2) # of timesProvidethe following: 1) Hours per day/week/month and minutes per use.Providethe following: 1) Range of running hours; 2) Portion of appliances running weekday and weekend.	N/A Temperature at which hot water is maintained. N/A N/A	PI PI PI N/ A	PI PI PI 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	SF	MF
				point		

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

#### 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

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

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

2.6.7	Step 3:	Factors	Normalized ener	gy I	Daily	or	Per	end	use	PI	PI
	Normalized	related to	use.	r	monthl	y	and	per un	it		
	Energy Use	energy									
		performance									
		indicators									

#### 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.

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

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

#### 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	Monthly (preferred)	N/A	PI	PI	N
	CDD	(acceptable)				
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	Ν
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 10 Itom	definitions	formulal	huilding	al ana atomiation	in Land	$\boldsymbol{C}$
<i>1 ubie 2-10 liem</i>	aejimiions	<i>for whole</i>	Dunung	churacteristics	in Levei	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	Ν
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	Ν
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	Ν
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	Ν
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	Air change rate provided in times/hour.	SI	SI	Y
	tightness				
3.3.2	Wall material	Wall material (select one or more): 1) Brick,	PI	PI	Y
		stone or stucco; 2) Concrete; 3) Concrete panels;			
		4) Siding or shingles; 5) Metal panels; 6) Curtain			
		glass; 7) Other			
3.3.3	Ceiling	Ceiling material (select one): 1) Brick 2)	PI	PI	Y
	material	Concrete; 3) Concrete panels; 4) Stone; 5)			
		Stucco; 6) Other			
3.3.4	Window	Indicate the frame type, number of panes, glass	PI	PI	Y
	material	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%.			
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	<ul> <li>Indicate the insulation materials for wall, ceiling, ground floor, basement wall, basement floor, attic and roof.</li> <li>Wall insulation material: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Batt; 5) Fiberboard sheathing; 6) Rockwool; 7) Other; 8) No insulation</li> <li>Roof insulation material: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Batt; 5) Fiberglass; 6) Rockwool; 7) Others; 8) No insulation</li> <li>Floor insulation material: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Batt; 5) Fiberglass; 6) Rockwool; 7) Others; 8) No insulation</li> <li>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</li> </ul>	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	<ul> <li>Shading system (select one or more): 1) Exterior shading; 2) Interior shading; 3) Within glazing system/façade system</li> <li>Exterior shading: 1) Awnings, 3) Solar screens; 4) Solar film; 5) Blinds; 6) Other; 7) None</li> <li>Interior shading: 1) blinds; 2) Shading cloths; 3) Other; 4) None</li> </ul>	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)	PI	PI	Y
		25%-35%; 3) $35%-45%$ ; 4) more than $45%$ . This should exclude the roof area			
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.

Code	Category	Item	Parameters	SF	MF	Parameter Used for Simulatio n (Y/N/?)
3.4.1	Air conditionin g - centralized	Parameter s 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

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

	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	Ν
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	Ν
	Energy efficiency label or not	SI	SI	Ν
3) District	Number of pumps	PI	PI	Y
space	Water volume	PI	PI	Y
heating/	Head for pumps	PI	PI	Y
cooling	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	Number of appliances	PI	PI	Y
water	Water volume	PI	PI	Y
pump	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	Ν

5)	Number of appliances	PI	PI	Y
Cooling	Water volume	PI	PI	Y
water	Head for pumps	PI	PI	Y
pump: fixed-	Total power of pumps	PI	PI	Y
frequency	Fan/pump efficiency (standard, high, premium)	SI	SI	Y
frequency conversio n	Energy efficiency label or not	SI	SI	Ν
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	Ν
7) FCU:	Number of appliances	PI	PI	Y
Two-pipe fan coil; Three pipe fan coil; Four pipe fan	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
coil	Fan efficiency (standard, high, premium)	SI	SI	Y
	Total power	PI	PI	Y
	Energy efficiency label or not	SI	SI	Ν
8) Radiative unit	Type of the units: 1) Radiators; 2) Floor radiative system; 3) Wall radiative systems; 4) Ceiling radiative systems; 5) Other	ΡI	PI	Ν
9)	Number of appliances	PI	PI	Y
Cooling Tower	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	Ν
10)	Number of appliances	PI	PI	Y
Pumps of	Head for pumps	PI	PI	Y
cooling	Total power	PI	PI	Y
systems	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	Ν
			Energy efficiency label or not	SI	SI	Ν
		12)	Number of appliances	PI	PI	Y
		Economiz er	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	Ν
		13) Other	Other	SI	SI	Ν
3.4.2	Space heating - Centralized	1) Heat sourc e(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	Ν
			Energy efficiency of the boiler (COP)	PI	PI	Y
			Energy efficiency label or not	SI	SI	Ν
		2) Hot	Number of appliances	PI	PI	Y
		water	Water volume	PI	PI	Y
		s pump	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	Ν
		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	Number of appliances	PI	PI	Y
		exchanger	Area of heat exchange for heat exchangers	SI	SI	Ν
			Energy efficiency label or not	SI	SI	N
		5)	Number of appliances	PI	PI	Y

		Economiz er	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	Ν
3.4.3	Space	Type of	Number of each type of heater	PI	PI	Ν
	heating -	decentrali	Fuel type	PI	PI	Y
	decentraliz	zed	Total power (w)	PI	PI	Y
	ed	(Select	Power rating of each type(w)	PI	PI	Y
		one or	Heat/cooling capacity (w)	PI	PI	Y
		more: 1)	Energy efficiency label or not	SI	SI	Ν
		Individual space heaters; 2) Furnaces; 3) Other)	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	Ν
			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	Ν
			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	Ы	N
			Number of each type	SI	SI	Ν
			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 -	Number of fans	Ы	PI	N
	decentralized	Total power	PI	PI	N
		Power intensity of each building activity area (w)	PI	PI	Y
		Pump efficiency (standard, high, premium)	SI	SI	Ν
		Locations served (select one or more): 1) Garage; 2) Basement; 3) Offices; 4) Restrooms; 6) Corridors; 7) Lobby; 8) Other	SI	SI	Ν
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	Ν
		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	Ν
		Energy efficiency label or not	SI	SI	Ν
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	Ν
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	Ν
			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	Ν
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	Ν
			Fuel type	PI	PI	Y
			Total power (w)	PI	PI	Ν
			Power intensity	PI	PI	Y
			Energy efficiency label or not	SI	SI	Ν
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	Ν
			Number of each type	SI	SI	Ν
			Total power (w)	PI	PI	Ν
			Power intensity (kw/m2)	PI	PI	Y
			Energy efficient label or not	SI	SI	Ν
3.4.12	Other	Types of other	Number of appliances	SI	SI	Ν
		equipment	Fuel type	PI	PI	Y
		used in the	Total power (w)	PI	PI	Ν
		building (Select one	Power intensity of each building activity area(kw/m2)	PI	PI	Y

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

### 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.

Item	Mode	Code	Definition	Paramet
				er Used
				for
				Simulat
				ion
				(Y/N/?)
Sche	Subschema 1:	1.1	Full time or part time (when occupied) in each month	Ν
dule	Time mode		or season.	
	(for appliances	1.2	Number of weeks or from week A to week B in each	Y
	with long daily		month, number of months or from month A to month B	
	operation		in each season, and one time period (from time A to	
	periods)		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.	
	Subschema 2:	2.1	Number of times per day/week/month and minutes per	Ν
	Event mode		time for use.	
	(for the		Starting time and ending time of this event	Y
	appliances	2.2		
	with short or			
	infrequent			
	operation			
	periods)			
	Subschema 3:	3.1	At which time periods for full load; at which time	Ν
	Load mode		periods for partial load.	

Table 2-21 subschema definitions in Level C

		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 $(x^{\circ}C)$ 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 $x^{\circ}C$ , 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 $x^{\circ}C$ - $x^{\circ}C$ . (For chilled water set point, cold/hot Deck Reset temperatures (cold/heating deck leaving temperature))	Y

ſ	1			
		9.2	When the outdoor temperature lower than $x^{\circ}C$ , reset	Y
			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 $x^{\circ}C-x^{\circ}C$ .	
			(For chilled water set point, cold/hot Deck Reset	
			temperatures (cold/heating deck leaving temperature))	
	Subschema 10:	10	A certain amount (x litres per person per day) of water	Y
	Flux mode for		use per person as if it is a set point (This subschema	
	hot water		could be used for simulation or calculation).	
~				
Cont	Subschema 11:	11 1	When the indoor temperature/humidity higher than $x C$ ,	Ν
rol	indoor	11.1	open it.	
	Temperature	11.0	When the indoor temperature/humidity lower than $x C$ ,	Ν
	mode	11.2	open it.	
	Subschema 12:	12.1	When there is a certain level of $CO_2$ or $CO$ , open it.	Ν
	Air quality	12.2	When there is a certain level of $CO_2$ or $CO$ , close it.	Ν
	mode			
			Variable frequency (For example: 1) Variable air	Y
	Subschema 13:	13.1	volume; 2) Variable water volume; 3) Variable	
	Frequency		refrigerant volume; 4) Other)	
	mode		Gear limit (For example: high/low speed only)	Ν
		13.2		
	Subschema 14:	14	When the illumination outside is $< x   ux$ , open it.	Ν
	Illumination			
	mode			
	Subschema 15:	15	When there are the occupants, open or use it.	Ν
	Personnel			
	mode			
	Subschema 16:	16	When solar irradiation is strong (such as >	N
	Solar		xJ/(cm2*min)), close it.	
	irradiation			
	mode			
	Subschema 17:	17.1	When not in use, turned off (appliances and lighting).	N
	On/off mode	17.2	When not in use, in standby mode (appliances and	N
		- /	lighting)	
		173	When not in use left on (appliances and lighting)	
		17.5		Ν
	Subschema 18.		When temperature difference is higher than $x^{\circ}C_{\cdot}$ open	
	Temperature	18	one or more machines etc	Ν
	difference $+$ #			
	of machines			
	running mode			
	running mode			

	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	<ol> <li>Open the window first, and then use the air conditioner.</li> <li>Use electrical fan, then use the air conditioner.</li> </ol>	N
	Subschema 23: Operator mode	23.1	Object controlled by occupants.	N
		23.2	Object controlled by building managers.	N
Spac e	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
Rand om	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.

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 2-22 Item definition of occupancy schedule in Level C* Occupancy Schedule

*Table 2-23 Item definition of operation of air conditioning system (centralized) in Level C* **Air Conditioning – Centralized** 

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

	Ì	Subschame 1.2: Number of weaks or from weak A to weak B	DI
		Subschema 1.2. Number of weeks of from week A to week B	P1
		in each month, number of months of 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.	DI
		Subschema 4.1 Percentage of the heat sources that are used.	PI
	Set Point	Subschema 6 (For supply/return temperature of hot water):	PI
		Always set at a certain point $(x \ C)$ for the hot water , etc. (If	
		possible, please indicate the specific indoor temperature	
		setback points when space is unoccupied.)	
		Subschema 7 (For supply/return temperature of hot water):	PI
		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.).	
		Subschema 9.1 When the outdoor temperature is higher than	SI
		$x \ C$ , 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 $x C - x C$ .	
		Subschema 9.2 When the outdoor temperature lower than $x^{\circ}C$ ,	SI
		reset the supply hot water temperature at a certain point	
		(usually a maximum point) or in the range of $x C - x C$ .	
	Control	Subschema 13.1 Variable frequency (For example: 1) Variable	
		air volume; 2) Variable water volume; 3) Variable refrigerant	PI
		volume; 4) Other)	
		Subschema 18 When temperature difference is higher than	SI
		$x^{\circ}C$ , open one or more machines, etc.	
		Subschema 23.2 Object controlled by building managers.	SI
	Space	N/A	
Cooling	Schedule	Subschema 1.1: Full time or part time (when occupied) in each	PI
sources		month or season.	
		Subschema 1.2 Number of weeks or from week A to week B in	PI
		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.	
		Subschema 4.1 Percentage of the heat sources that are used.	PI
	Set Point	Subschema 6 (For supply/return temperature of chilled water):	PI
		Always set at a certain point $(x^{\circ}C)$ for the chilled water/hot	
		water, etc. (If possible, please indicate the specific indoor	
		temperature setback points when space is unoccupied.)	
		Subschema 7 (For supply/return temperature of chilled water):	PI
		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.).	

		Subschema 9.1 (For supply/return temperature of chilled	SI
		water): When the outdoor temperature is higher than $x^{\circ}C$ , 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 $x^{\circ}C - x^{\circ}C$	
		Subschema 9.2 (For supply/return temperature of chilled	SI
		Subschema 9.2 (For suppry/return temperature of enfield water). When the outdoor temperature lower than $x^{\circ}$ reset the	51
		supply shilled water temperature of a cortain point (usually a	
		supply clinical water temperature at a certain point (usually a maximum point) or in the range of $x \cap x \cap$	
	C a m t m a 1	School and 12 1 Variable for success (Far arranged at 1) Variable	DI
	Control	Subschema 13.1 variable frequency (For example: 1) variable	PI
		air volume; 2) variable water volume; 3) variable refrigerant	
		volume; 4) Other)	~ ~
		Subschema 18 When temperature difference is higher than	SI
		x°C, open one or more machines, etc.	
		Subschema 23.2 Object controlled by building managers.	SI
	Space	N/A	
District	Schedule	Subschema 1.1: Full time or part time (when occupied) in each	PI
space		month or season.	
heating/co		Subschema 1.2 Number of weeks or from week A to week B in	PI
oling		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.	
	Set Point	Subschema 6 (For supply/return temperature of hot/cold	PI
		water): Always set at a certain point $(x^{\circ}C)$ for the hot/chilled	
		water , etc. (If possible, please indicate the specific indoor	
		temperature setback points when space is unoccupied.)	
		Subschema 7 (For supply/return temperature of hot/cold	PI
		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.).	
		Subschema 9.1 For supply/return temperature of hot/cold	SI
		water):When the outdoor temperature is higher than x°C, 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 $x^{\circ}C-x^{\circ}C$ .	
		Subschema 9.2 For supply/return temperature of hot/cold	SI
		water): When the outdoor temperature lower than $x^{\circ}C$ . reset	
		the supply hot/chilled water temperature at a certain point	
		(usually a maximum point) or in the range of $x^{\circ}C$ - $x^{\circ}C$ .	
	Control	Subschema 13.1 Variable frequency (For example: 1) Variable	Ы
	2011101	air volume: 2) Variable water volume: 3) Variable refrigerant	
		volume: 4) Other)	
		Subschema 23.2 Object controlled by building managers	SI
	L	zaczenia zel object tena enea og ounanig nanagers	~-

	Space	Subschema 24: supplied in the full space.	SI
		Subschema 25: supplied in part of the space. Indicate the	SI
		percentage of area or which areas in each zone supplied.	
Chilled	Schedule	Subschema 1.1: Full time or part time (when occupied) in each	PI
water		month or season.	
pump		Subschema 1.2 Number of weeks or from week A to week B in	PI
		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.	
		Subschema 4.1 Percentage of the pumps that are used.	PI
	Control	Subschema 13.1:Variable frequency (For example: 1) Variable	PI
		air volume; 2) Variable water volume; 3) Variable refrigerant	
		volume; 4) Other)	
		Subschema 13.2:Gear limit (For example: high/low speed	
		only)	PI
		Subschema 18: When temperature difference is higher than	SI
		$x^{\circ}C$ , open one or more machines, etc.	
		Subschema19: The loop is active (i.e., pumps on) whenever	SI
		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)	
		Subschema 20: The loop activates according to a user-defined	SI
		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)	
		Subschema 21: The loop is active only when a coil load (i.e.,	SI
		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)	
		Subschema 23.2 Object controlled by building managers.	SI
	Space	N/A	
Cooling	Schedule	Subschema 1.1: Full time or part time (when occupied) in each	PI
water		month or season.	
pump		Subschema 1.2 Number of weeks or from week A to week B in	PI
		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.	
		Subschema 4.1 Percentage of the pumps that are used.	PI

	Control	Subschema 13.1: Variable frequency (For example: 1) Variable	Ы
	Connor	air volume: 2) Variable water volume: 3) Variable refrigerant	
		volume: 4) Other)	
		Subschema 13.2 Gear limit (For example: high/low speed	
		only)	РI
		Subschema 18: When temperature difference is higher than	SI
		$x^{\circ}C$ , open one or more machines, etc.	~ -
		Subschema 19: The loop is active (i.e., pumps on) whenever	SI
		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)	
		Subschema 20: The loop activates according to a user-defined	SI
		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)	
		Subschema 21: The loop is active only when a coil load (i.e.,	SI
		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)	
		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	PI
		month or season.	
		Subschema 1.2 Number of weeks or from week A to week B in	PI
		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.	
	~ ~ ·	Subschema 4.1 Percentage of the fans that are used.	PI
	Set Point	Subschema 6: Usually set the supply cold/hot air temperature	PI
		at a specific point (If possible, please indicate the specific	
		temperature setback point when not occupied.).	DI
		Subschema /: Usually set the supply cold/hot air temperature	Ч
		In the range of $x \in -x \in ($ If possible, please indicate the specific	
		temperature setback ranges when not occupied.).	CI.
		Subschema 8:Reset the supply cold/hot air temperature based	51
		on the actual load so that the valve of the worst-case coil is	
		tully open.	

		Subschema 9.1: When the outdoor temperature is higher than $x^{\circ}C$ , reset the supply cold/hot air at a certain point (usually a minimum point) or in the range of $x^{\circ}C-x^{\circ}C$ . (For cold/hot Deck Reset temperatures (cold/heating deck leaving temperature))	SI
		Subschema 9.2: When the outdoor temperature lower than $x^{\circ}C$ , reset the cold/hot supply air temperature at a certain point (usually a maximum point) or in the range of $x^{\circ}C-x^{\circ}C$ . (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	PI
		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.	
		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 $x^{\circ}C-x^{\circ}C$ (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 $x^{\circ}C$ , reset the supply cold/hot air at a certain point (usually a minimum point) or in the range of $x^{\circ}C-x^{\circ}C$ . (For cold/hot Deck Reset temperatures (cold/heating deck leaving temperature))	SI

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

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

	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	2
Snace Heating _ Centralized			

Space neat	<u>ing – Centra</u>		
Object	Item	Potential Subschema	SF/MF
indoor temperatu	Schedule	Subschema 5: At what time period when the indoor temperature is setback	SI
re	Set Point	Subschema 6 Always set at a certain point $(x^{\circ}C)$ 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 $x^{\circ}C$ , reset indoor temperature at a certain point (usually a minimum point) or in the range of $x^{\circ}C$ - $x^{\circ}C$ .	SI
		Subschema 9.2 When the outdoor temperature lower than $x^{\circ}C$ , reset the indoor temperature at a certain point (usually a maximum point) or in the range of $x^{\circ}C$ - $x^{\circ}C$ .	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 $(x^{\circ}C)$ 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):	Ы
		Loughly set the supply temperature of hot water in the range of	11
		(minimum) = u(maximum) (If passible place indicate the	
		x(minimum) – y(maximum) (in possible, please indicate the	
		specific temperature setback ranges when not occupied.).	CI.
		Subschema 9.1 When the outdoor temperature is higher than	81
		x C, 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 °C -x °C.	
		Subschema 9.2 When the outdoor temperature lower than $x^{\circ}C$ ,	SI
		reset the supply hot water temperature at a certain point	
		(usually a maximum point) or in the range of $x C - x C$ .	
	Control	Subschema 13.1 Variable frequency (For example: 1) Variable	
		air volume; 2) Variable water volume; 3) Variable refrigerant	PI
		volume; 4) Other)	
		Subschema 18 When temperature difference is higher than	SI
		$x^{\circ}C$ , open one or more machines, etc.	
		Subschema 23.2 Object controlled by building managers.	SI
	Space	N/A	
hot water	Schedule	Subschema 1.1: Full time or part time (when occupied) in each	PI
pump		month or season.	
		Subschema 1.2 Number of weeks or from week A to week B in	PI
		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.	
		Subschema 4.1 Percentage of the pumps that are used.	PI
	Control	Subschema 13.1: Variable frequency (For example: 1) Variable	PI
		air volume; 2) Variable water volume; 3) Variable refrigerant	
		volume; 4) Other)	
		Subschema 13.2:Gear limit (For example: high/low speed	
		only)	PI
		Subschema 18: When temperature difference is higher than	SI
		$x^{\circ}C$ , open one or more machines, etc.	
		Subschema19: The loop is active (i.e., pumps on) whenever	SI
		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)	
		Subschema 20: The loop activates according to a user-defined	SI
		schedule. The default schedule matches the fan schedule,	
		which initially makes this option functionally identical to	
		which initially makes this option functionally identical to "Standby." (CHW LOOP PUMP CONTROL/hot water system	

		Subschema 21: The loop is active only when a coil load (i.e.,	SI
		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)	
		Subschema 23.2 Object controlled by building managers	SI
	Space	N/A	
Heat	Schedule	Subschema 1.1. Full time or part time (when occupied) in each	Ы
exchanger	Seneaure	month or season	
enemanger		Subschema 1.2 Number of weeks or from week A to week B in	Ы
		each month number of months or from month A to month B in	11
		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 F	
		to time F etc.) on typical weekdays and weekends	
		Subschema 4.1 Percentage of the heat exchangers that are	Ы
		opened or used.	11
	Control	Subschema 13.1:Variable frequency (For example: 1) Variable	PI
		air volume; 2) Variable water volume; 3) Variable refrigerant	
		volume; 4) Other)	
		Subschema 13.2:Gear limit (For example: high/low speed	
		only)	PI
		Subschema 23.1 Object controlled by occupants.	SI
	Space	N/A	
Radiator/	Schedule	Subschema 1.1: Full time or part time (when occupied) in each	PI
(Floor/wa		month or season.	
ll/ceiling		Subschema 1.2 Number of weeks or from week A to week B in	PI
radiative		each month, number of months or from month A to month B in	
systems)		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.	
		Subschema 4.1 Percentage of the radiative system that is	SI
		opened or used.	
	Set Point	Subschema 6: Usually set the supply hot air temperature at a	PI
		specific point (If possible, please indicate the specific	
		temperature setback point when not occupied.).	
		Subschema 7: Usually set the supply hot air temperature in the	PI
		range of $x^{\circ}C-x^{\circ}C$ (If possible, please indicate the specific	
		temperature setback ranges when not occupied.).	
		Subschema 9.2: When the outdoor temperature lower than $x^{\circ}C$ ,	SI
	1	· · · · · · · · · · · · · · · · · · ·	
		reset the hot supply air temperature at a certain point (usually a	
		reset the hot supply air temperature at a certain point (usually a maximum point) or in the range of $x^{\circ}C-x^{\circ}C$ . (For hot Deck	
		reset the hot supply air temperature at a certain point (usually a maximum point) or in the range of $x^{\circ}-x^{\circ}$ . (For hot Deck Reset temperatures (heating deck leaving temperature))	
	Control	reset the hot supply air temperature at a certain point (usually a maximum point) or in the range of $x^{\circ}C-x^{\circ}C$ . (For hot Deck Reset temperatures (heating deck leaving temperature)) Subschema 23.1 (For personal space) Object controlled by	SI

	Space	Subschema 24: supplied in the full space.	PI
		Subschema 25: supplied in part of the space. Indicate the	PI
		percentage of area or which areas in each zone supplied.	
Economiz	Schedule	Subschema 1.1: Full time or part time (when occupied) in each	PI
er		month or season.	
		Subschema 1.2 Number of weeks or from week A to week B in	PI
		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.	
		Subschema 4.1 Percentage of the economizers that is opened or	PI
		used.	
	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** 

Space Heat	nig – Decenti anzeu	
Item	Potential Subschema	SF/MF
Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or	PI
	season.	
	Subschema 1.2 Number of weeks or from week A to week B in each month,	PI
	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.	
	Subschema 4.1 Percentage of the space heaters that are used.	PI
Set Point	Subschema 6 Always set at a certain point (x°C) for the indoor temperature	PI
	(If possible, please indicate the specific indoor temperature setback points	
	when space is unoccupied.)	
	Subschema 7 Usually set the indoor temperature in the range of x(minimum)	PI
	- y(maximum) (If possible, please indicate the specific temperature setback	
	ranges when not occupied.).	
	Subschema 9.1 When the outdoor temperature is higher than x°C, reset indoor	SI
	temperature at a certain point (usually a minimum point) or in the range of	
	$\mathbf{x}^{\circ}\mathbf{C} - \mathbf{x}^{\circ}\mathbf{C}$ .	
	Subschema 9.2 When the outdoor temperature lower than x°C, reset the	SI
	indoor temperature at a certain point (usually a maximum point) or in the	
	range of $x^{\circ}C-x^{\circ}C$ .	
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	PI
	or which areas in each zone supplied.	

*Table 2-26 Item definition of operation of air conditioning system (decentralized) in Level C* <u>Air Conditioning – Decentralized</u>

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	PI
	period (from time A to time B) or several time periods (from time C to time D AND from time E to time E, etc.) on twnical weekdays and weekends	
	Subschema 4.1 Percentage of AC that are used.	PI
Set Point	Subschema 6 Always set at a certain point $(x^{\circ}C)$ 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 $x^{\circ}C$ , reset indoor temperature at a certain point (usually a minimum point) or in the range of $x^{\circ}C - x^{\circ}C$ .	SI
	Subschema 9.2 When the outdoor temperature lower than $x^{\circ}C$ , reset the indoor temperature at a certain point (usually a maximum point) or in the range of $x^{\circ}C-x^{\circ}C$ .	SI
\Control	<ul><li>Subschema 22</li><li>1. Open the window first, then use the air conditioner.</li><li>2. Use electrical fan, then use the air conditioner.</li></ul>	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 entilation (mechanic) – Centralized/Decentralized

Ventilation	(mechanic) – Centralized/Decentralized		
Item	Potential Subschema	SF	MF
Schedule	Subschema 1.1: Full time or part time (when occupied) in each month	PI	PI
	or season.		
	Subschema 1.2 Number of weeks or from week A to week B in each	PI	PI
	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.		
	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	SI	SI
Space	$x^{\circ}C$ , open it.		

Subschema 11.2: When the indoor temperature/humidity lower than x°C,	SI	SI
open it.		
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	PI	PI
volume; 2) Variable water volume; 3) Subschema		
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	PI	PI
area or which areas in each zone supplied.		

*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	PI	PI
	typical weekdays and weekends.	DI	DI
	Subschema 4.1 Percentage of lights that are used. 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	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

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	PI	PI
	periods (from time C to time D AND from time E to time F, etc.) on typical weekdays and weekends.		
Set Point	Subschema 6: Always set at a certain point $(x^{\circ}C)$ 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 $x^{\circ}C$ , reset the supply temperature of domestic hot water at a certain point (usually a minimum point) or in the range of $x^{\circ}C$ - $x^{\circ}C$ .	SI	SI
	Subschema 9.2: When the outdoor temperature lower than $x^{\circ}C$ , 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 $x^{\circ}C$ - $x^{\circ}C$ .	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

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

\*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** 

Domestic ciece	are appliances		
Item	Potential Subschema	SF	MF
~			
Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or	PI	PI
	season.		
	Subschema 1.2 Number of weeks or from week A to week B in each	PI	PI
	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.		

	Subschema 4.1 Percentage of appliances that are used.	PI	PI
	Subschema 3.3 Fraction of the nominal appliance power (value between 0	PI	PI
	and 1) for each hour during business hours, break time, non-business		
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

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	PI	PI
	per day) of water use per person as if it is a set point (This subschema could be used for simulation or calculation).		
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
~P	Subschema 25: supplied in part of the space. Indicate the percentage of	PI	PI
	area or which areas in each zone supplied.		

Table 2-32 Item	definition o	f occupant	behavior of	of window	opening in	Level C
10000 2 32 10000		occupant	001101101 0	1 1111111111111111111111111111111111111	opening in	Derer C

<b>Windows</b>	v	U	1	v	1	0			
Item	Potential S	ubschen	na					SF	MF

Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or	PI	PI					
	season.							
	Subschema 1.2 Number of weeks or from week A to week B in each	PI	PI					
	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.							
	Subschema 4.1: Percentage of the windows that are opened.	PI	PI					
	Subschema 4.3: Percentage of window opening width for each hour of	PI	PI					
	the day when the building is occupied and unoccupied.							
	Subschema 26 The change of object's status has no certain discipline,	SI	SI					
	and runs randomly.							
Set Point	N/A							
Control	Subschema 11.1: When the indoor temperature/humidity higher than	SI	SI					
	x°C, open it.							
	Subschema 11.2: When the indoor temperature/humidity lower than $x^{\circ}C$ ,	SI	SI					
	open it.							
	Subschema 12.1: When there is a certain level of $CO_2$ or $CO_2$ 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

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

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

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

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

## 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.

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 environm ental satisfactio n 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

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

I-3

Three level data typologies for office buildings

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### 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**

Code	Item	Definition	ΙΟ	CO
1.3.1	Material	<ul> <li>This includes walls, ceiling, floor, and window material.</li> <li>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</li> <li>Walls insulated (Y/N?)</li> <li>Roof material (select one): 1) Brick 2) Concrete; 3) Concrete panels; 4) Stone; 5) Wood; 6) Other</li> <li>Roof insulated (Y/N?)</li> <li>Window material <ul> <li>Select one frame type: 1) Aluminium, 2) Plastic steel; 3) Steel, 4) Wood; 5) Other</li> <li>Select number of panes: 1) Single; 2) Double; 3) Triple; 4) Other</li> <li>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</li> <li>Select the percentage of operable windows: 1) Not operable; 2) Less than 10%; 3) 10%-30%; 4) 30%-60%; 5) More than 60%</li> </ul> </li> </ul>	SI	SI
1.3.2	U-value	Provided for each of the building envelope components above $(m, M, m,$	PI	PI
		(wan, cenning, windows, etc.) using the units: w/(m2*K).		
1.3.3	Window	Select one of the following: 1) 25 % or less; 2) 25%-35%; 3) 35%-	PI	PI
	to wall	45%; 4) more than 45%. This should exclude the roof area.		
	ratio			

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

## 1.4 **Building services and energy systems**

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

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

	1						
1.4.4	Air	Type of the decentralized air	Fuel	Total	Heat/cooling	PI	N/A
	conditioning	conditioner (Select one or	type	power	capacity (w)		
	-	more: 1) Residential-type A/C;		(w)			
	decentralized	2) Individual room A/C; 3)					
		Other)					
1.4.5	Ventilation -	Type of centralized system	Fuel	Total		N/A	PI
	centralized	(Select one or more: 1)	type	power			
		Mechanical exhaust system;	• •	(w)			
		2)Plenum system; 3) Other)		Ì,			
1.4.6	Ventilation -	Type of local fans	Fuel	Total		PI	N/A
	decentralized		type	power			
			21	(w)			
1.4.7	Lighting	*Types of lighting (Select one	Fuel	Total		SI	SI
	0 0	or more: 1) Incandescent bulbs;	type	power			
		2) Fluorescent bulbs; 3)	21	(w)			
		Compact fluorescent bulbs; 4)		<b>`</b>			
		LEDs; 5) Other) including					
		indoor and outdoor lighting					
1.4.8	Office	*Type(s) of appliances (Select	Fuel	Total		SI	SI
	appliances	one or more: 1) Computer	type	power		~	
		including monitor: 2) Server:	- 10	(w)			
		3) Copier: 4) Scapper: 5)		()			
		Telephone/fax: 6) Printer: 7)					
		Teleconference system: 8)					
		Other)					
149	Other	*Types of other equipment	Fuel	Total		SI	SI
1.1.9	other	used in the building Select one	type	nower		51	51
		or more.	type	(w)			
		• 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					
		• Other: 1) Elevator: 2)					
		• Other: 1) Elevator; 2) Security monitors: 2) Other					
1	1	Security monitors, 5) Other	1	1		1	

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**

Code	Item	Mode	Schedule	ΙΟ	СО
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

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

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

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

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

### 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.

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 temperatu re (°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 illuminati on	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

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

### 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	SI	SI
		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.		
2.2.2	Number of	Indicate the number of floors.	SI	SI
	floors			

2.2.3	Conditioned	The floor area of conditioned floor space, as measured at the	PI	PI
	and/or heated	floor level within the external surfaces of walls enclosing the		
	floor area	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%.		
2.2.4	Gross floor	Gross floor area is calculated including external walls of the	PI	PI
	area	building. The attached space should also be included, such as		
		basement, attic, etc.		
2.2.5	Average	Average number of occupants that are normally in the	PI	PI
	number of	building.		
	occupants			
2.2.6	Type of	Indicate the type of building: 1) Government office; 2)	SI	SI
	building	Business/professional office; 3) Multi-use complex; 4) Other.		
2.2.7	Building	Select one or more of the following: 1) Office; 2) Conference	PI	PI
	activity areas	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.		
2.2.8	Gross floor	Provide floor area for all space/activity types listed in 2.2.7	PI	PI
	area occupied			
	by each activity			

# 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	<ul> <li>This includes walls, ceiling, floor, and window material.</li> <li>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</li> <li>Wall insulation material: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Batt; 5) Fiberboard sheathing; 6) Rockwool; 7) Other; 8) No insulation</li> <li>Roof material (select one): 1) Brick 2) Concrete; 3) Concrete panels; 4) Stone; 5) Wood; 6) Other</li> <li>Roof insulation material: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Batt; 5) Fiberglass; 6) Rockwool; 7) Others; 8) No insulation</li> <li>Floor material (select one): 1) Brick; 2) Concrete; 3) Stone; 4) Stucco; 5) Other</li> <li>Floor insulation material: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Other; 5) No insulation</li> <li>Floor material (select one): 1) Brick; 2) Concrete; 3) Stone; 4) Stucco; 5) Other</li> <li>Floor insulation material: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Other; 5) No insulation</li> <li>Window material</li> <li>Select one frame type: 1) Aluminum, 2) Plastic steel; 3) Steel, 4) Wood; 5) Other</li> </ul>	PI	PI

		<ul> <li>Select number of panes: 1) Single; 2) Double; 3) Triple; 4) Other</li> <li>Select one glass type: 1) Flat glass; 2) Insulating glass; 3) Insulating glass-AR; 4) Insulating glass-KR; 5) Low- e; 6) Other</li> <li>Select the percentage of operable windows: 1) Not operable; 2) Less than 10%; 3) 10%-30%; 4) 30%-60%; 5) More than 60%</li> <li>Shading system <ul> <li>Select one or more: 1) External overhangs; 2) Awnings; 3) Solar screens; 4) Solar film; 5) Other</li> <li>Indicate: 1) Exterior; 2) Interior; 3) Within glazing system/façade system 4) Other</li> </ul> </li> </ul>		
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	Comprehen sive 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

Cod	Item	Definition			-			ΙΟ	CO
e									
2.4.1	Space	Type of central space	Number	Fuel	Total	Heat	Floor	N/	PI
	heating	heating system	of	type	powe	capacity	area of	А	
	_	(Select one: 1)	systems		r (w)	of the	zone		
	centrali	District steam hot				bldg.(w	served		
	zed	water; 2) Boilers				)	by each		
		inside the building;					type of		
		3) Other)					system		
2.4.2	Space	Type of	Number	Fuel	Total			PI	N/
	heating	decentralized system	of each	type	powe				А
	-	(Select one or more:	type of		r (w)				
	decentr	1) Individual space	heater						
	alized	heaters; 2) Furnaces;							
		3) Other)							

2.4.3	Air	Type of central air	Number	Fuel	Total	Heat/	Floor	N/	PI
	conditi	conditioning systems	of	type	powe	cooling	area of	А	
	oning -	(Select one or more:	systems		r (w)	capacity	zone		
	centrali	1) District chilled				of the	served		
	zed	water; 2) Heat pump;				bldg.	by each		
		3) Central chillers;				(w)	type of		
		4)Evaporative					system		
		coolers; 5)Natural							
		heat sink; 6) Other)							
2.4.4	Air	Type of the	Number	Fuel	Total	Heat/co		PI	N/
	conditi	decentralized air	of each	type	powe	oling			A
	oning -	conditioner (Select	type of		r (w)	capacity			
	decentr	one or more: 1)	aır			(w)			
	alized	Residential-type	condition						
		A/C; 2) Individual $A/C$ ; 2) $A/C$ ;	er						
215	Vontilat	room A/C; 3) Other)	Mumhar	Encl	Totol			<b>N</b> 1/	DI
2.4.3	ventilat	Type of centralized	number	ruei	rotar			1N/	P1
	1011 -	system (Select one of more: 1) Machanical	01 avatama	type	powe			А	
	zed	avbaust: 2) Planum	systems		1 (w)				
	ZCU	system: 3) Other)							
246	Ventilat	Type of local fans	Number	Fuel	Total			рI	N/
2.4.0	ion -	Type of local fails	of fans	type	nowe			11	Δ
	decentr		01 14115	type	r (w)				11
	alized				1 ()				
2.4.7	Lightin	Types of lighting	Number	Fuel	Total	Control		PI	PI
	g	(Select one or more:	of	type	powe	method			
	e	1) Incandescent	lighting	21	r (w)	(photo/			
		bulbs; 2) Fluorescent	applianc			occupan			
		bulbs; 3) Compact	es			cy/sche			
		fluorescent bulbs;				duling)			
		4) LEDs; 5) Other)							
		including indoor and							
		outdoor lighting							
2.4.8	Office	Type(s) of	Number	Fuel	Total			PI	PI
	applian	appliances (Select	of	type	powe				
	ces	one or more: 1)	applianc		r (w)				
		Computer, including	es						
		monitor;							
		2) Server; 3) Copier;							
		4) Scanner;							
		5) Telephone/fax;							
		6) Printer;							
		7) Teleconference							
		system; 8) Other)							

2.4.9	Other	Types of other	Number	Fuel	Total		SI	SI
		equipment used in	of	type	powe			
		the building. Select	applianc	21	r (w)			
		one or more:	es					
		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						

#### 2.5 **Building operation and occupant behavior**

### 2.5.1 Occupancy

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

Table 3-11 Item definition of occupancy in Level B

### 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.

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

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

2.5.6	Space cooling - decentraliz ed	<ul> <li>2) Full space, only occupied time; 3)</li> <li>Only occupied space, full time; 4)</li> <li>Only occupied space, only occupied time.</li> <li>Select one of the following modes: 1)</li> <li>Full space, full time; 2)</li> <li>Full space, only occupied time; 3)</li> <li>Only occupied space full time; 4)</li> </ul>	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) Running hours during business/non-business hours for each season; 2) Running hours during weekday/ weekend hours for each season; 3) Hours	Range of set points; 3) If possible indicate set points when occupied and unoccupied. Provide the following: 1) Set point; 2) Range of set points; 3) If possible indicate set	PI	N/ A
		Space, full time, 4) Only occupied space, only occupied time.	when indoor temperature is set back on weekday/ weekend, separately.	points when occupied and unoccupied.		
2.5.7	Ventilation (mechanic) - Toilet/kitch en	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/g arage	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	<ul> <li>Select one of the following modes for personal devices (e.g., desktop, monitor, laptop, personal printer, etc.):</li> <li>1) Full time (turned on 24 hours/day)</li> <li>2) Standby when not in use</li> <li>3) Only turn on when in use, off when not in use</li> <li>3) Only turn on grinter, etc.):</li> <li>1) Full time (turned on 24 hours/day)</li> <li>2) Standby when not in use</li> <li>3) Only turn on when in use, off when not in use</li> <li>3) Only turn on of the following modes for public devices (e.g., public printer, copier, water fountain, etc.):</li> <li>1) Full time (turned on 24 hours/day)</li> <li>2) Turn off during off hours</li> <li>3) Standby during off hours</li> <li>4) Only turn on when in use, off when not in use</li> </ul>	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,	N/A	Provide the following: 1) Range of running hours; 2) Percentage of	N/A	SI	SI
	water		appliances running			

heating	weekday	and weekend.		
other)				

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

Table 3-13 Item definition of the	e occupant behaviour of win	idow. shading and curtain	s use in Level B

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

#### 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

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

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

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

# 3. Complex version for office buildings – Level C database

## 3.1 **Climate and indoor thermal environment**

Cod	Item	Frequency	Location	Ю	С	Parameter
e					0	Used for
3.1.1	HDD and	Monthly or annual.	N/A	PI	PI	Simulatio
	CDD					n (Y/N/?)
3.1.2	Weather data	Hourly or daily		PI	PI	Ν
						Y
3.1.3	Indoor	Hourly, daily or	Indicate the indoor temperature	PI	PI	Y
	temperature	seasonal,	for each HVAC zone or the			
	(°C)	weekday/weekend	whole building.			
		or day/night.				
3.1.4	Ventilation	Daily or seasonal,	Indicate the indoor ventilation	PI	PI	Ν
	rate	weekday/weekend	rate for each activity area or the			
		or day/night.	whole building.			
3.1.5	Indoor	Hourly, daily, or	Indicate the indoor humidity for	SI	SI	Ν
	humidity	seasonal,	each HVAC zone or the whole			
		weekday/weekend	building.			
		or day/night.				
3.1.6	Indoor	Daily or seasonal,	Indicate the indoor illumination	SI	SI	Ν
	illumination	weekday/weekend	for each activity zone or the			
		or day/night.	whole building.			
3.1.7	Index	Daily or seasonal,	Indicate the TVOC	SI	SI	Ν
	pollutants	weekday/weekend	concentration for each activity			
	concentrations	or day/night.	zone or the whole building.			

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

(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	ΙΟ	СО	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.	ΡI	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).	ΡI	PI	Ν
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	of huilding	envelope and	l other	components in Leve	cl C
10010 5 17 110111		1 COULDENTS	chirope whe	000000	componentis in Berg	$\sim$
			1		1	

Code	Item	Definition	ΙΟ	СО	Parameter Used for Simulatio n (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	<ul> <li>Indicate the frame type, number of panes, glass type and percentage of operable windows.</li> <li>1. Options for glass type: 1) Flat glass;</li> <li>2) Insulating glass; 3) Insulating glass-AR; 4)</li> <li>Insulating glass-KR; 5) Low -e; 6) Other</li> <li>2. Select number of panes: 1) Single; 2) Double;</li> <li>3) Triple; 4) Other</li> <li>3. Select one frame type: 1) Aluminum, 2) Plastic steel; 3) Steel, 4) Wood; 5) Vinyl; 6) Other</li> <li>4. Select the percentage of operable window: 1)</li> <li>Not operable; 2) less than 10%; 3) 10%-30%;</li> </ul>	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	<ol> <li>"Lay-In Acoustic Tile; 2)"Drywall Finish;</li> <li>3)Plaster Finish; 4)others; 5)None</li> </ol>	SI	SI	Y
3.3.7	Insulation material	<ul> <li>Indicate the insulation materials for wall, ceiling, ground floor, basement wall, basement floor and roof.</li> <li>Options for wall: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Batt; 5) Fiberboard sheathing; 6) Rockwool; 7) Other; 8) No insulation</li> <li>Options for roof: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Batt; 5) Fiberglass; 6) Rockwool; 7) Others; 8) No insulation</li> <li>Options for ground floor: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Other; 5) No insulation</li> <li>Options for basement wall: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Batt; 5) Fiberboard sheathing; 6) Rockwool; 7) Other; 8) No insulation</li> <li>Options for basement wall: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Batt; 5) Fiberboard sheathing; 6) Rockwool; 7) Other; 8) No insulation</li> <li>Options for basement floor: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Batt; 5) Fiberboard sheathing; 6) Rockwool; 7) Other; 8) No insulation</li> <li>Options for basement floor: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Batt; 5) Fiberboard sheathing; 6) Rockwool; 7) Other; 8) No insulation</li> <li>Options for basement floor: 1) Polystyrene; 2) Polyurethane; 3) Polyisocyanurate; 4) Other; 5) No insulation</li> <li>Options for roof: 1) Loose fill; 2) Batts; 3) Spray-on; 4) Rigid; 5) Unknown insulation; 6) Not insulated; 7) Other</li> </ul>	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	<ul> <li>Shading system (select one or more): 1) Exterior shading; 2) Interior shading; 3) Within glazing system/façade system</li> <li>Exterior shading: 1) Awnings, 3) Solar screens; 4) Solar film; 5) Blinds; 6) Other; 7) None</li> <li>Interior shading: 1) blinds; 2) Shading cloths; 3) Other; 4) None</li> </ul>	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	Ν

	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/bli nds	Provide the material and colour of curtains/blinds.	SI*	SI*	Y

# 3.4 **Building services and energy systems**

Code	Category	Item	Parameters	ΙΟ	СО	Parameter Used for Simulation (Y/N/?)
3.4.1		Parameters used for the overall	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
	Air conditioni ng -	Air conditioni ng - centralize d	Ventilation Rate Per Occupant: The minimum allowable flow rate of outside ventilation air per person (based on peak occupancy).	N/A	SI	Y
	d		Other overall performance	N/A	SI	Ν
	u		Type(s) of heating sources (select one or more): 1) Boilers; 2) Heat pumps; 3) Other	N/A	PI	Y
		Heat	Number of each type of component	N/A	PI	Y
		source(s)	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

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

	Control method: 1) Programmable	N/A	SI	Ν
	thermostat; 2) Manual thermostat; 3)			
	Digital thermostat; 4) Timer; 5) Part			
	of EMCS; 6) Other			
	Heat source efficiency (COP)	N/A	PI	Y
	Energy efficiency label or not	N/A	SI	Ν
	Type(s) of cooling sources (select	N/A		Y
	one or more): 1) Heat pumps; 2)			
	Central chillers inside the building;		DI	
	3) Evaporative or swamp coolers; 4)		11	
	Condenser; 5) Natural heat sink; 6)			
	Other			
	Number of each type of component	N/A	PI	Y
	Energy type	N/A	PI	Y
Cooling	Cooling source efficiency (EER)	N/A	PI	Y
source(s)	Power rating (kw)	N/A	PI	Υ
	Cooling capacity supplied by each	N/A	DI	Y
	type of cooling sources		11	
	Control method: 1) Programmable	N/A	SI	Ν
	thermostat; 2) Manual thermostat; 3)			
	Digital thermostat; 4) Timer; 5) Part			
	of EMCS; 6) Other			
	Energy efficiency label or not	N/A	SI	N
	Number of pumps	N/A	PI	Y
	Water volume	N/A	PI	Y
2) District	Head for pumps	N/A	PI	Y
space	Total power of pumps	N/A	PI	Y
heating/		N/A	ы	Y
cooling	Heating/cooling capacity		ГI	
	Efficiency of the heat pipe network	N/A	SI	Ν
	(please indicate length of pipes and			
	thickness of insulation if possible)	3.7/4		
	Number of appliances	N/A	PI	Y
	Water volume	N/A	PI	Y
4) Chilled	head for pumps	N/A	PI	Y
water numn	Total power of pumps	N/A	PI	Y
	Pump efficiency (standard, high,	N/A	SI	Y
	premium)			
	Energy efficiency label or not	N/A	SI	Y
5) Cooling	Number of appliances	N/A	PI	Y
water	Water volume	N/A	PI	Y
pump:	Head for pumps	N/A	PI	Y

fixed-	Total power of pumps	N/A	PI	Y
frequency/	Fan/pump efficiency (standard, high,	N/A	SI	Y
frequency	premium)			
conversion	Energy efficiency label or not	N/A	SI	N
	Number of appliances	N/A	PI	Y
6) AHI I	Total power	N/A	PI	Y
0)71110	Fan efficiency (standard, high, premium)	N/A	SI	Y
	Energy efficiency label or not	N/A	SI	Ν
	Number of appliances	N/A	PI	Y
7) FCU: Two-pipe fan coil; Three pipe	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	N/A	SI	Y
fan coil; Four pipe fan coil	(maximum) conditions. Fan efficiency (standard, high, premium)	N/A	SI	Y
	Total power	N/A	PI	Y
	Energy efficiency label or not	N/A	SI	Ν
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	Ν
	Number of appliances	N/A	PI	Y
9) Cooling	Volume of cooling water (m <sup>3</sup> /h), air volume (m <sup>3</sup> /h)	N/A	SI	Y
Tower	Total power	N/A	PI	Y
	Energy efficiency label or not	N/A	SI	N
	Number of appliances	N/A	SI	Y
10) Pumps	Head for pumps	N/A	SI	Y
of cooling	Total power	N/A	PI	Y
storage systems	Pump efficiency (standard, high, premium)	N/A	SI	Y
-	Energy efficiency label or not	N/A	SI	N
	Number of appliances	N/A	PI	Y
11) Heat exchanger	Area of heat exchange for heat exchangers	N/A	PI	N

			Energy efficiency label or not	N/A	SI	Ν
			Number of appliances	N/A	PI	Y
		12) Economize r	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	Ν
		13) Other	Other	N/A	SI	Ν
			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
		3) Heat	Power rating (kw)	N/A	PI	Y
		Space neating -	Heat capacity supplied by each type of the heat sources	N/A	PI	Y
	Space		Control method: 1) Programmable thermostat; 2) Manual thermostat; 3) Digital thermostat; 4) Timer; 5) Part of EMCS; 6) Other	N/A	SI	Ν
			Energy efficiency of the boiler (COP)	N/A	PI	Y
3.4.2	heating -		Energy efficiency label or not	N/A	SI	N
	d		Number of appliances	N/A	PI	Y
			Water volume	N/A	PI	Y
		4) Hot	head for pumps	N/A	PI	Y
		pumps	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	Ν
		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	Number of appliances	N/A	PI	Y
		exchanger	Area of heat exchange for heat exchangers	N/A	S	N

			Energy efficiency label or not	N/A	SI	Ν
			Number of appliances	N/A	PI	Y
		5) Economize r	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
		Type of	Number of each type of heater	PI	N/A	Ν
		decentraliz	Fuel type	PI	N/A	Y
	~	ed system	Total power (w)	PI	N/A	Y
	Space	(Select one	Power rating of each type(w)	PI	N/A	Y
3.4.3	heating -	or more: 1)	Heat/cooling capacity (w)	PI	N/A	Y
	decentrali	Individual	Energy efficiency label or not	SI	N/A	Ν
	zed	eu space heaters; 2) Furnaces; 3) Other)	Other performance	SI	N/A	N
	Air conditioning -		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	Ν
3.4.4	decentralized	ed	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	Ν
			Other performance (humidification/dehumidification capacity)	SI	N/A	N
			Number of each type	N/A	PI	Ν
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)	N/A	PI	Ν
			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	N/A	PI	
		more): 1) Garage; 2) Basement; 3)			Y
		Offices; 4) Restrooms; 6) Corridors; 7) Lablerr 9) Other			
		/) Lobby; 8) Other	<b>N</b> T/A	CI.	N
		ventilation rate	N/A	51	N
		Number of fans	SI	N/A	Ν
		Power intensity of each building	PI	N/A	Y
	Ventilation -	Pump efficiency (standard high	SI	N/A	V
3.4.6	decentralized	premium)	51	14/21	1
		Locations served (select one or	SI	N/A	Y
		more): 1) Garage; 2) Basement; 3)			
		Offices; 4) Restrooms; 6) Corridors;			
		/) Lobby; 8) Other			N
		Types of lighting (Select one or			N
		Fluorescent bulbs: 3) Compact			
		fluorescent bulbs: 4) LEDs: 5)	PI	PI	
		Other) including indoor and outdoor			
		lighting			
		Number of lighting appliances	PI	PI	N
	Lighting	Fuel type	SI	SI	N
3.4.7	88	Control method: 1) Daylight	SI	SI	Ν
		dimming; 2) Occupancy sensors; 3)			
		Manual dimming; 4) Bi-level			
		control; 5) Manual; 6) Part of			
		EMCS; 7) Other			
		Power density for each activity area	PI	PI	Y
		Total power (w)	PI	PI	N
		Energy efficiency label or not	SI	SI	N
		Type(s) of appliances (Select one or			
		more: 1) Computer, including			Ν
		monitor; 2) Server; 3) Copier; 4)	PI	PI	
3.4.8		Scanner; 5) Telephone/fax; 6)			
		Other)			
	Office appliances	Number of appliances	DI	DI	N
		Fuel type	DI	DI	V
		Power density for each activity area	PI	PI	I V
		Total nower (w)	рі	DI	I N
		Energy efficiency label or not	SI	SI	N
		Other performance	SI	SI	N
		Other performance	51	51	± 1

		<ul> <li>Types of other equipment used in the building. Select one or more:</li> <li>Water heating appliances: 1) <ul> <li>District hot water; 2) Central hot water system; 3) Hot water at point sources; 4) Other</li> </ul> </li> <li>Kitchen appliances: 1) Oven; 2) <ul> <li>Cooktop; 3) Microwave; 4)</li> <li>Coffee maker; 5) Toaster oven; 6)</li> <li>Refrigerator; 7) Separate freezer;</li> <li>B) Dishwasher; 9) Toaster; 10)</li> <li>Other</li> </ul> </li> <li>Other: 1) Elevator; 2) Security monitors; 3) Other</li> </ul>	SI	SI	Ν
3.4.9	Other	Number of appliances	SI	SI	Ν
		Fuel type	SI	SI	Y
		Power density for each activity area	SI	SI	Y
		Total power (w)	PI	PI	Ν
		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	Ν
		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

Item	Mode	Code	Definition	Paramet er Used for Simulat ion (Y/N/?)
Sched ule	Subschema 1: Time	1.1	Full time or part time (when occupied) in each month or season.	Ν
	mode (for appliances with long daily operation periods)	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	2.1	At which time periods for full load; at which time periods for partial load	Ν
	mode (for the appliances with short or infrequent operation periods)	2.2	Starting time and ending time of this event	Y
		3.1	At which time periods for full load; at which time periods for partial load.	N
	Subschema 3: Load	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
	niode	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
		4.1	Percentage of the objects (fan, shades, lighting, window, etc.) that are opened or used.	Y
	Subschema 4: Portion	4.2	Fraction of the nominal occupancy (value between 0 and 1) for each hour of the day for offices and meeting rooms.	Y
	mode	4.3	Percentage of shades closed/window opening width for each hour of the day when the building is occupied and unoccupied.	Y

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

	Subschema	5	At what time period when the indoor temperature is	
	5:		setback	
	Temperatur			Ν
	e setback			
	mode			
Set	Subschema	6	Always set at a certain point $(x^{\circ}C)$ for the indoor	Y
point	6: Single		temperature or supply temperature for domestic hot	
	point mode		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.)	
	Subschema	7	Usually set the indoor temperature or supply temperature	Y
	7: Range		of domestic hot water, chilled water set point,	
	mode		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	
	Subsahama	Q	Paget the supply cold/hot air/water temperature based on	V
	Subscheina 8. Load	0	the actual load so that the valve of the worst case coil is	1
	o. Luau mode		fully open (For hot water set point chilled water set	
	mode		noint)	
	Subschema	91	When the outdoor temperature is higher than $x^{\circ}$ reset	V
	$9^{\circ}$ Outdoor	7.1	the supply cold/hot air/water temperature and supply	1
	temperature		temperature of domestic hot water at a certain point	
	mode		(usually a minimum point) or in the range of $x^{\circ}-x^{\circ}$ .	
			(For chilled water set point, cold/hot Deck Reset	
			temperatures (cold/heating deck leaving temperature))	
		9.2	When the outdoor temperature lower than $x^{\circ}C$ , reset the	Y
			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 $x^{\circ}C-x^{\circ}C$ .	
			(For chilled water set point, cold/hot Deck Reset	
			temperatures (cold/heating deck leaving temperature))	
	Coole on 1	10	A certain amount (x litres per person per day) of water	Y
	Subschema		use per person as if it is a set point (This subschema	
	10. Flux		could be used for simulation or calculation).	
	hot water			
	Subschema	111	When the indoor temperature/humidity higher than $\mathbf{x}^{\circ}$	N
	11. indoor	11.1	open it	T A
	Temperatur	11.2	When the indoor temperature/humidity lower than $\mathbf{x}^{\circ}$	N
	e mode	11.4	open it	11
	Subschema	12.1	When there is a certain level of $CO_2$ or $CO_2$ open it.	N

12: Air	12.2	When there is a certain level of $CO_2$ or $CO$ , close it.	Ν
quality mode			
Subschema 13: Frequency	13.1	Variable frequency (For example: 1) Variable air volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	Y
mode	13.2	Gear limit (For example: high/low speed only)	Ν
Subschema 14: Illuminatio n 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.	Ν
Subschema	17.1	When not in use, turned off (appliances and lighting).	Ν
17: On/off mode	17.2	When not in use, in standby mode (appliances and lighting).	Ν
	17.3	When not in use, left on (appliances and lighting).	N
Subschema 18: Temperatur e difference + # of machines running mode	18	When temperature difference is higher than $x^{\circ}C$ , open one or more machines, etc.	Ν
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	<ol> <li>Open the window first, and then use the air conditioner.</li> <li>Use electrical fan, then use the air conditioner.</li> </ol>	N
	Subschema 23:	23.1	Object controlled by occupants.	N
	Operator mode	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
Rando m	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	ΙΟ	CO		

Schedule	Subschema 1.2: Number of weeks or from week A to week B in each	PI	PI
	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.		
Set Point	N/A		
Control	N/A		
Space	N/A		

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

 ccupancy Schedule

Occupanc	y Schedule		
Item	Potential Subschema	ΙΟ	CO
Schedul e	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	N/A		
Point			
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 – Cent	ralized
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Object	Item	Potential Subschema	СО
indoor	Schedule	Subschema 5: At what time period when the indoor temperature	SI
temperatu		is setback	
re,	Set Point	Subschema 6 Always set at a certain point $(x^{\circ}C)$ for the indoor	PI
		temperature (If possible, please indicate the specific indoor	
		temperature setback points when space is unoccupied.)	
		Subschema 7 Usually set the indoor temperature in the range of	PI
		x(minimum) – y(maximum) (If possible, please indicate the	
		specific temperature setback ranges when not occupied.).	
		Subschema 9.1 When the outdoor temperature is higher than $x^{\circ}C$ ,	SI
		reset indoor temperature at a certain point (usually a minimum	
		point) or in the range of $x^{\circ}C - x^{\circ}C$ .	

		Subschema 9.2 When the outdoor temperature lower than $x^{\circ}C$ ,	SI
		reset the indoor temperature at a certain point (usually a maximum	
		point) or in the range of $x^{\circ}C-x^{\circ}C$ .	
	Control	N/A	
	Space	Subschema 24, in full space	Ы
	~ F	Subschema 25 set in part of the space. Indicate the percentage of	PI
		area or which areas in each zone where the specific temperature is	
		set.	
Heat	Schedule	Subschema 1.1: Full time or part time (when occupied) in each	Ы
sources		month or season.	
		Subschema 1.2: Number of weeks or from week A to week B in	PI
		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.	
		Subschema 4.1 Percentage of the heat sources that are used.	PI
	Set Point	Subschema 6 (For supply/return temperature of hot water):	PI
		Always set at a certain point $(x^{\circ}C)$ for the hot water, etc. (If	
		possible, please indicate the specific indoor temperature setback	
		points when space is unoccupied.)	
		Subschema 7 (For supply/return temperature of hot water):	PI
		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.).	
		Subschema 9.1 When the outdoor temperature is higher than $x^{\circ}C$ ,	SI
		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 $x^{\circ}C - x^{\circ}C$ .	
		Subschema 9.2 When the outdoor temperature lower than $x^{\circ}C$ ,	SI
		reset the supply hot water temperature at a certain point (usually a	
		maximum point) or in the range of $x C - x C$ .	
		Subschema 13.1 Variable frequency (For example: 1) Variable air	PI
		volume; 2) Variable water volume; 3) Variable refrigerant	
	Control	volume; 4) Other)	
	control	Subschema 18 When temperature difference is higher than $x^{\circ}C$ ,	SI
		open one or more machines, etc.	
		Subschema 23.2 Object controlled by building managers.	SI
	Space	N/A	
Cooling	Schedule	Subschema 1.1: Full time or part time (when occupied) in each	PI
sources		month or season.	
		Subschema 1.2 Number of weeks or from week A to week B in	PI
		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.	

		Subschema 4.1 Percentage of the heat sources that are used.	PI
	Set Point	Subschema 6 (For supply/return temperature of chilled water):	PI
		Always set at a certain point $(x^{\circ}C)$ for the chilled water/hot water,	
		etc. (If possible, please indicate the specific indoor temperature	
		setback points when space is unoccupied.)	
		Subschema 7 (For supply/return temperature of chilled water):	PI
		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.).	
		Subschema 9.1 (For supply/return temperature of chilled water):	SI
		When the outdoor temperature is higher than $x \ \mathbb{C}$ , 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 $x^{\circ}C - x^{\circ}C$ .	
		Subschema 9.2 (For supply/return temperature of chilled	SI
		water):When the outdoor temperature lower than $x^{\circ}C$ , reset the	
		supply chilled water temperature at a certain point (usually a	
		maximum point) or in the range of $x^{\circ}C-x^{\circ}C$ .	
		Subschema 13.1 Variable frequency (For example: 1) Variable air	PI
		volume; 2) Variable water volume; 3) Variable refrigerant	
	Control	volume; 4) Other)	
	Control	Subschema 18 When temperature difference is higher than $x^{\circ}C$ ,	SI
		open one or more machines, etc.	
		Subschema 23.2 Object controlled by building managers.	SI
	Space	N/A	
District	Schedule	Subschema 1.1: Full time or part time (when occupied) in each	PI
space		month or season.	
heating/c		Subschema 1.2 Number of weeks or from week A to week B in	PI
ooling		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.	
	Set Point	Subschema 6 (For supply/return temperature of hot/cold water):	PI
		Always set at a certain point $(x^{\circ}C)$ for the hot/chilled water, etc.	
		(If possible, please indicate the specific indoor temperature	
		setback points when space is unoccupied.)	
		Subschema 7 (For supply/return temperature of hot/cold water):	PI
		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.).	
		Subschema 9.1 For supply/return temperature of hot/cold	SI
		water):When the outdoor temperature is higher than $x C$ , 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 $x^{\circ}C - x^{\circ}C$ .	

	i i i i i i i i i i i i i i i i i i i		-
		Subschema 9.2 For supply/return temperature of hot/cold water): When the outdoor temperature is lower than $x^{\circ}C$ , reset the supply hot/chilled water temperature at a certain point (usually a maximum point) or in the range of $x^{\circ}C$ - $x^{\circ}C$ .	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	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
	Control	Subscheme 13 1:Variable fraguency (For avample: 1) Variable air	DI
	Control	volume; 2) Variable water volume; 3) Variable refrigerant volume; 4) Other)	I I
		Subschema 13.2:Gear limit (For example: high/low speed only)	PI
		Subschema 18: When temperature difference is higher than $x^{\circ}C$ ,	SI
		open one or more machines, etc.	
		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

numn		Subschema 1.2 Number of weeks or from week A to week B in	ΡI
pump		each month number of months or from month A to month B in	11
		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 E ata) on typical weakdays and weakends	
		Subscheme 4.1 Decentage of the number that are used	DI
		Subschema 4.1 Percentage of the pumps that are used.	PI
	Control	Subschema 13.1: Variable frequency (For example: 1) Variable air	PI
		volume; 2) Variable water volume; 3) Variable refrigerant	
		Subschema 13.2:Gear limit (For example: high/low speed only)	Ы
		Subschema 18.2.3 Star innet (1 of chample, high low speed only) Subschema 18: When temperature difference is higher than $x^{\circ}$	SI
		open one or more machines etc	51
		Subscheme 10: The lean is active (i.e., numps on) whenever any	C1
		subschema 19. The loop is active (i.e., pumps on) whenever any	51
		Note that in this mode even if all of the thermostate in all of the	
		Note that in this mode even if an of the thermostats in an of the	
		zones served by the loop are satisfied (i.e., no load), the loop will	
		CONTROL (het water garter control)	
			CI
		Subschema 20: The loop activates according to a user-defined	81
		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)	GT
		Subschema 21: The loop is active only when a coil load (i.e.,	SI
		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)	
		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	PI
		month or season.	
		Subschema 1.2 Number of weeks or from week A to week B in	PI
		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.	
		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	PI
		specific point (If possible, please indicate the specific temperature	
		setback point when not occupied.).	
		Subschema 7: Usually set the supply cold/hot air temperature in	PI
		the range of $x^{\circ} - x^{\circ} $ (If possible, please indicate the specific	
		temperature setback ranges when not occupied.).	

		Subschame 8: Paset the supply cold/hot air temperature based on	SI
		Subschema 8. Reset the suppry condition an temperature based on	51
		the actual load so that the valve of the worst-case coll is fully	
		Open.	CI.
		Subschema 9.1. when the outdoor temperature is higher than $x \in \mathcal{C}$ ,	51
		reset the supply cold/not air at a certain point (usually a minimum	
		point) or in the range of x C-x C. (For cold/not Deck Reset	
		temperatures (cold/heating deck leaving temperature))	
		Subschema 9.2: When the outdoor temperature is lower than $x^{\circ}C$ ,	SI
		reset the cold/hot supply air temperature at a certain point (usually	
		a maximum point) or in the range of $x^{\circ}C-x^{\circ}C$ . (For cold/hot Deck	
		Reset temperatures (cold/heating deck leaving temperature))	
	Control	Subschema 13.1:Variable frequency (For example: 1) Variable air	
		volume; 2) Variable water volume; 3) Variable refrigerant	PI
		volume; 4) Other)	
		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	PI
		percentage of area or which areas in each zone supplied.	
FCU fan	Schedule	Subschema 1.1: Full time or part time (when occupied) in each	PI
		month or season.	
		Subschema 1.2 Number of weeks or from week A to week B in	PI
		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.	
		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	PI
		specific point (If possible, please indicate the specific temperature	
		setback points when not occupied.).	
		Subschema 7: Usually set the supply cold/hot air temperature in	Ы
		the range of $x^{\circ}C - x^{\circ}C$ (If possible, please indicate the specific	
		temperature setback ranges when not occupied.).	
		Subschema 8. Reset the supply cold/hot air temperature based on	SI
		the actual load so that the valve of the worst-case coil is fully	21
		onen	
		Subschema 9.1. When the outdoor temperature is higher than $x^{\circ}$	SI
		reset the supply cold/hot air at a certain point (usually a minimum	
		point) or in the range of $x^{\circ}C-x^{\circ}C$ (For cold/hot Deck Reset	
		temperatures (cold/heating deck leaving temperature))	
		Subschema 9.2. When the outdoor temperature lower than $x^{\circ}$	SI
		reset the cold/hot supply air temperature at a certain point (usually	51
		a maximum point) or in the range of $\mathbf{x}^{\circ} - \mathbf{x}^{\circ}$ (For cold/hot Deck	
		Reset temperatures (cold/heating deck leaving temperature))	
		[ reset temperatures (cold/heating deck leaving temperature))	

	Control	Subschema 13.1: Variable frequency (For example: 1) Variable air	PI
		volume; 2) Variable water volume; 3) Variable refrigerant	
		volume; 4) Other)	
		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	PI
		percentage of area or which areas in each zone supplied.	
Cooling	Schedule	Subschema 1.1: Full time or part time (when occupied) in each	PI
tower		month or season.	
		Subschema 1.2 Number of weeks or from week A to week B in	PI
		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.	
		Subschema 4.1 Percentage of the cooling towers that are opened	PI
		or used.	
	Control	Subschema 18 When temperature difference is higher than $x^{\circ}C$ ,	SI
		open one or more machines, etc.	
		Subschema 23.2 Object controlled by building managers.	SI
	Space	N/A	
Pumps for	Schedule	Subschema 1.1: Full time or part time (when occupied) in each	PI
cooling		month or season.	
storage		Subschema 1.2 Number of weeks or from week A to week B in	PI
systems		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.	
		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	PI
		volume; 2) Variable water volume; 3) Variable refrigerant	
		volume; 4) Other)	
		Subschema 13.2:Gear limit (For example: high/low speed only)	PI
		Subschema 23.1 Object controlled by occupants.	SI
	Space	N/A	
Heat	Schedule	Subschema 1.1: Full time or part time (when occupied) in each	PI
exchanger		month or season.	
		Subschema 1.2 Number of weeks or from week A to week B in	PI
		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.	

		Subschema 4.1 Percentage of the heat exchangers that are opened	PI
		or used.	
	Control	Subschema 13.1:Variable frequency (For example: 1) Variable air	PI
		volume; 2) Variable water volume; 3) Variable refrigerant	
		volume; 4) Other)	
		Subschema 13.2:Gear limit (For example: high/low speed only)	PI
		Subschema 23.1 Object controlled by occupants.	SI
	Space	N/A	
Radiator/	Schedule	Subschema 1.1: Full time or part time (when occupied) in each	PI
Floor/wal		month or season.	
l/ceiling		Subschema 1.2 Number of weeks or from week A to week B in	PI
radiative		each month, number of months or from month A to month B in	
systems		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.	
		Subschema 4.1 Percentage of the radiative system that is opened	SI
		or used.	
	Set Point	Subschema 6: Usually set the supply cold/hot air temperature at a	PI
		specific point (If possible, please indicate the specific temperature	
		setback point when not occupied.).	
		Subschema 7: Usually set the supply cold/hot air temperature in	PI
		the range of $x^{\circ}C-x^{\circ}C$ (If possible, please indicate the specific	
		temperature setback ranges when not occupied.).	
		Subschema 9.1: When the outdoor temperature is higher than $x^{\circ}C$ ,	SI
		reset the supply cold/hot air at a certain point (usually a minimum	
		point) or in the range of $x^{\circ}C-x^{\circ}C$ . (For cold/hot Deck Reset	
		temperatures (cold/heating deck leaving temperature))	
		Subschema 9.2: When the outdoor temperature lower than $x^{\circ}C$ ,	SI
		reset the cold/hot supply air temperature at a certain point (usually	
		a maximum point) or in the range of $x^{\circ}C-x^{\circ}C$ . (For cold/hot Deck	
		Reset temperatures (cold/heating deck leaving temperature))	
	Control	Subschema 23.1 (For personal space) Object controlled by	SI
		occupants.	
	Space	Subschema 24: supplied in the full space.	PI
	•	Subschema 25: supplied in part of the space. Indicate the	PI
		percentage of area or which areas in each zone supplied.	
Economiz	Schedule	Subschema 1.1: Full time or part time (when occupied) in each	PI
er		month or season.	
		Subschema 1.2 Number of weeks or from week A to week B in	PI
		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.	
		Subschema 4.1 Percentage of the economizers that is opened or	PI
		used.	
•	L		•
Control	Subschema 23.2 Object controlled by building managers	SI	
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Space	N/A		

Table 3-23 Iter	n definition	of the	operation	of space	heating	(centralized)	in Level	l C
and Heating	Controlized							

<u>Space Heating – C</u>	<u>Centralized</u>		
Item	Potential S	Subschema	Ю
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 $(x^{\circ}C)$ 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 $x^{\circ}C$ , 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 $x^{\circ}C$ - $x^{\circ}C$ .	SI
		Subschema 9.2 When the outdoor temperature lower than $x^{\circ}C$ , reset the supply hot water temperature at a certain point (usually a maximum point) or in the range of $x^{\circ}C$ - $x^{\circ}C$ .	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 $x^{\circ}C$ , open one or more machines, etc.	SI
		Subschema 23.2 Object controlled by building managers.	SI
	Space	N/A	
	Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or season.	PI
Hot water 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	PI
		air volume; 2) Variable water volume; 3) Variable refrigerant	
		volume; 4) Other)	
		Subschema 13.2:Gear limit (For example: high/low speed	PI
		only)	
		Subschema 18: When temperature difference is higher than	SI
		x C, open one or more machines, etc.	
		Subschema 19: The loop is active (i.e., pumps on) whenever	SI
		any one of the systems served by the loop is running (i.e., fans	
		of the zones served by the loop are satisfied (i.e., no load) the	
		loop will be active (i.e., pumps running) (CHW LOOP PLIMP	
		CONTROL/hot water system control)	
		Subschema 20: The loop activates according to a user-defined	SI
		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)	
		Subschema 21: The loop is active only when a coil load (i.e.,	SI
		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	
		Subschema 23.2 Object controlled by building managers	SI
	Space	N/A	51
	Schedule	Subschema 1.1: Full time or part time (when occupied) in each	PI
		month or season.	
		Subschema 1.2 Number of weeks or from week A to week B	PI
		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.	DI
Heat exchanger		Subschema 4.1 Percentage of the heat exchangers that are	PI
	Control	Subscheme 13 1: Variable frequency (For example: 1) Variable	DI
	Control	air volume: 2) Variable water volume: 3) Variable refrigerant	r i
		volume: 4) Other)	
		Subschema 13.2:Gear limit (For example: high/low speed	PI
		only)	
		Subschema 23.1 Object controlled by occupants.	SI
	Space	N/A	
Radiator/	Schedule	Subschema 1.1: Full time or part time (when occupied) in each	PI
Floor/wall/ceiling		month or season.	
radiative systems			

	1	Subscheme 1.2 Number of weaks or from weak A to weak B	DI
		Subschema 1.2 Number of weeks of from week A to week B	I I
		In each month, number of months of from month A to month $\mathbf{D}$	
		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.	
		Subschema 4.1 Percentage of the radiative system that is	SI
		opened or used.	
	Set Point	Subschema 6: Usually set the supply cold/hot air temperature	PI
		at a specific point (If possible, please indicate the specific	
		temperature setback point when not occupied.).	
		Subschema 7: Usually set the supply cold/hot air temperature	PI
		in the range of $x^{\circ}C-x^{\circ}C$ (If possible, please indicate the	
		specific temperature setback ranges when not occupied.).	
		Subschema 9.1: When the outdoor temperature is higher than	SI
		$x^{\circ}C$ , reset the supply cold/hot air at a certain point (usually a	~
		minimum point) or in the range of $x^{\circ} - x^{\circ} $ (For cold/hot	
		Deck Reset temperatures (cold/heating deck leaving	
		temperature))	
		Subschema 9.2: When the outdoor temperature lower than	SI
		Subscripting $y_{2}$ , which the outdoor temperature rower than $y_{2}^{\circ}$ reset the cold/hot supply air temperature at a certain	51
		$x \in C$ , reset the condition supply an temperature at a certain point (usually a maximum point) or in the range of $x \cap C$ $x \cap C$	
		(Ten cold/het Deck Dect termentures (cold/heting deck	
		(For cold/not Deck Reset temperatures (cold/neating deck	
	$C \rightarrow 1$	leaving temperature))	CI
	Control	Subschema 23.1 (For personal space) Object controlled by	SI
		occupants.	
	Space	Subschema 24: supplied in the full space.	PI
		Subschema 25: supplied in part of the space. Indicate the	PI
		percentage of area or which areas in each zone supplied.	
	Schedule	Subschema 1.1: Full time or part time (when occupied) in each	PI
		month or season.	
		Subschema 1.2 Number of weeks or from week A to week B	PI
		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)	
Economizer		or several time periods (from time C to time D AND from	
		time E to time F, etc.) on typical weekdays and weekends.	
		Subschema 4.1 Percentage of the economizers that is opened	PI
		or used.	
	Control	Subschema 23.2 Object controlled by building managers	SI
	Space	N/A	
			1

*Table 3-24 Item definition of the operation of space heating (decentralized) in Level C* <u>Space Heating – Decentralized</u>

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,	PI
	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.	
	Subschema 4.1 Percentage of the space heaters that are used.	SI
Set Point	Subschema 6 Always set at a certain point $(x^{\circ}C)$ for the indoor temperature (If	PI
	possible, please indicate the specific indoor temperature setback points when	
	space is unoccupied.)	
	Subschema 7 Usually set the indoor temperature in the range of x(minimum) –	PI
	y(maximum) (If possible, please indicate the specific temperature setback ranges	
	when not occupied.).	
	Subschema 9.1 When the outdoor temperature is higher than x°C, reset indoor	SI
	temperature at a certain point (usually a minimum point) or in the range of $x^{\circ}C$ -	
	x°C.	
	Subschema 9.2 When the outdoor temperature lower than $x^{\circ}C$ , reset the indoor	SI
	temperature at a certain point (usually a maximum point) or in the range of $x^{\circ}C$ -	
	x°C.	
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	PI
	which areas in each zone supplied.	

*Table 3-25 Item definition of the operation of air conditioning (decentralized) in Level C* **Air Conditioning – Decentralized** 

	onnig – Decenti anzeu	
Item	Potential Subschema	Ю
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,	PI
	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.	
	Subschema 4.1 Percentage of AC that are used.	PI
Set Point	Subschema 6 Always set at a certain point $(x^{\circ}C)$ for the indoor temperature (If	PI
	possible, please indicate the specific indoor temperature setback points when	
	space is unoccupied.)	
	Subschema 7 Usually set the indoor temperature in the range of x(minimum) –	PI
	y(maximum) (If possible, please indicate the specific temperature setback ranges	
	when not occupied.).	
	Subschema 9.1 When the outdoor temperature is higher than $x^{\circ}C$ , reset indoor	SI
	temperature at a certain point (usually a minimum point) or in the range of $x^{\circ}C$ -	
	x℃.	

	Subschema 9.2 When the outdoor temperature lower than $x^{\circ}C$ , reset the indoor temperature at a certain point (usually a maximum point) or in the range of $x^{\circ}C$ - $x^{\circ}C$ .	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	PI
	which areas in each zone supplied.	

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

 Ventilation (mechanic) – Centralized/Decentralized

Item	Potential Subschema	Ю	СО
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 $x^{\circ}C$ , open it.	SI	SI
	Subschema 11.2:When the indoor temperature/humidity lower than $x^{\circ}C$ , 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 $CO_2$ 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

Lighting			
Item	Potential Subschema	ΙΟ	CO

Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or	PI	PI
	season.		
	Subschema 1.2 Number of weeks or from week A to week B in each	PI	PI
	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.		
	Subschema 4.1 Percentage of lights that are used.	PI	PI
	Subschema 3.2 Fraction of the nominal lighting power (value between 0	PI	PI
	and 1) for each hour during business hours, break time, non-business		
	hours (overtime and weekends) and holidays.		
	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	SI	SI
	managers.		
Space	Subschema 24: supplied in the full space.	PI	PI
	Subschema 25: supplied in part of the space. Indicate the percentage of	PI	PI
	area or which areas in each zone supplied.		

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

Office applia	aces		
Item	Potential Subschema	IO	CO
Schedule	Subschema 1.1: Full time or part time (when occupied) in each month	PI	PI
	or season.		
	Subschema 1.2 Number of weeks or from week A to week B in each	PI	PI
	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.		
	Subschema 4.1 Percentage of appliances that are used.	PI	PI
	Subschema 3.3 Fraction of the nominal appliance power (value between	PI	PI
	0 and 1) for each hour during business hours, break time, non-business		
	hours (overtime and weekends) and holidays.		
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	SI	SI
managers.								

	Table 3-29 It	em definition	of the	operation	of other	appliances	in Level	C
Dtl	her							

<u>Other</u>			
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

<u>Windows</u>			
Item	Potential Subschema	IO	CO
Schedule	Subschema 1.1: Full time or part time (when occupied) in each month or	PI	PI
	season.		
	Subschema 1.2 Number of weeks or from week A to week B in each month,	PI	PI
	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.		
	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	PI	PI
	day when the building is occupied and unoccupied.		
	Subschema 26 The change of object's status has no certain discipline, and	SI	SI
	runs randomly.		
Set Point	N/A		

Control	Subschema 11.1: When the indoor temperature/humidity higher than x°C,	SI	SI
	open it.		
	Subschema 11.2:When the indoor temperature/humidity lower than $x^{\circ}C$ ,	SI	SI
	open it.		
	Subschema 12.1: When there is a certain level of $CO_2$ or $CO_2$ 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

ItemPotential SubschemaIOIOScheduleSubschema 1.1: Full time or part time (when occupied) in each month or season.PISubschema 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.IO	CO PI PI
ScheduleSubschema 1.1: Full time or part time (when occupied) in each month or season.PISubschema 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 PI
season.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 1.2 Number of weeks or from week A to week B in each month, PI 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
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.	
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.	
D AND from time E to time F, etc.) on typical weekdays and weekends.	
Subschema 4.3 Percentage of shades closed width for each hour of the day PI	PI
when the building is occupied and unoccupied.	
Subschema 26 The change of object's status has no certain discipline, and SI	SI
runs randomly.	
Set Point N/A	
ControlSubschema 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

Code	Item		Definition	Frequency	Scope	IO	CO
3.6.1	Step 1: Energ y Carrier	Fuel consumpti on	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 consumpti on	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 consumpti on	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 consumpti on	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: Aggre gation of Energ y		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: Norma lized Energ y Use	Factors related to energy performan ce 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

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

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