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SEMANCO Semantic Tools for Carbon Reduction in Urban Planning

SEMANCO

Deliverable 3.2
Guidelines for Structuring Energy Data

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DoW	Deliverable 3.2 is based on the work done in Task 3.2 - *Structuring available data according to energy standards*. In Task 3.2, the energy data provided by Task 3.1 are modelled according to international standards, like ISO and CEN standards. Besides these standards, energy data models proposed by ICT4e2b projects and other European projects are analysed and considered in the modelling of non-structured energy datasets.				
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5	2013-01-21	Nina Dunlavy (NEA)	Proofreading and text revision

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EXECUTIVE SUMMARY

Introduction

Deliverable 3.2 summarises the work done and the results achieved in Task 3.2 *Structuring available data according to energy standards*, carried out within Work Package 3 - *Energy data modelling.* Tasks 3.2 provides the ontological modelling of energy data (i.e. energy systems, energy quantities and boundary conditions) identified in Task 2.1 *Case study design*, applying the data categorisation and the terminology defined in Task 3.1 *Providing access to distributed energy data repositories*.

Task 3.2 is developed in parallel with Task 3.3 *Structuring contextual data according to standards* because they both concern the data modelling: Task 3.2 is about the energy data, while Task 3.3 is about the energy related data or contextual data. The present deliverable concerns the guidelines for structuring energy data, while Deliverable 3.3 (due month 18) will contain the guidelines for structuring contextual data.

The development of the ontology is the basis for the creation of the SEIF (*Semantic Energy Information Framework*) in WP4, which will facilitate access to distributed energy data for the tools developed in WP5.

Deliverable 3.2 deals with the following items:

- The identification of the categories of data to be semantically modelled.
- The analysis of the main international standards for energy data modelling.
- The definition of the ontology structure and the creation of the *Standard Tables*.
- The elaboration of *Mapping Tables* to create correspondence between the ontology and input data deriving from the data sources or from the tools.

The following project partners have been involved in Task 3.2: POLITO, FUNITEC, UoT, CIMNE and HAS. Deliverable 3.2 has been elaborated by POLITO, which is the leader both of Task 3.2 and of the entire WP3. The information on data have been provided by the partners responsible for the case studies: RAMBOLL, NEA, UoT, CIMNE and FORUM.

Task 3.2 gives a fundamental contribution to the development of the Use Case methodology (Deliverable 1.8) as the core of SEMANCO. In fact, all the input data and the outputs in the Activities belonging to the Use Cases related to energy systems, energy quantities and boundary conditions were semantically modelled in Task 3.2, and Deliverable 3.2 provides the guidelines that have been followed to achieve this goal.

Classification of energy data

In Deliverable 3.1, some data categories have been defined to classify available data in the case studies (energy, energy cost, climatic, environmental, building technical, legislative, geographical, land and buildings registry, urban planning, socio-economic and demographic). In order to perform the ontological modelling of data, these data categories have been further classified into two groups:

- Energy systems, energy quantities and boundary conditions data (defined generally as "energy data" in the title of the present deliverable), which are the topic of Del 3.2.
- Energy-related data or contextual data, which will be analysed in Del. 3.3.

The former group includes data that are essential to perform an energy and environmental analysis, while the latter group includes data that are related to energy but are not indispensable for carrying out an energy analysis.

The following data categories of Deliverable 3.1 belong to the former group: Energy data, Climatic data, Building technical data.

The following data categories of Deliverable 3.1 belong to the latter group: Energy cost data, Environmental data, Legislative constraints, Geographical data, Land and buildings registry data, Urban planning data, Socio-economic data, Demographic data.

Structure of energy data

Analysis of technical standards and of literature on energy data modelling

The ontological modelling of data has to be developed through a common and shared terminology. The definitions of terms and their conceptualisation are provided by the literature, and specifically by the international technical standards, which supply the correct terminology, the descriptions, the relationships among concepts and, if applicable, the symbols and the units of the defined quantities.

The main technical standards for structuring data on energy systems, energy quantities and boundary conditions are the following:

- **ISO/IEC CD 13273-1:2012** – *Energy efficiency and renewable energy sources. Common international terminology*. *Part 1: Energy Efficiency*. It contains transversal concepts and their definitions in the fields of energy efficiency.
- **ISO/IEC CD 13273-2:2012** – *Energy efficiency and renewable energy sources. Common international terminology. Part 2: Renewable Energy Sources*. It contains transversal concepts and their definitions in the fields of renewable energy sources.
- **CEN/TR 15615:2008** – *Explanation of the general relationship between various CEN standards and the Energy Performance of Buildings Directive (EPBD)*, and the corresponding **ISO/TR 16344:2011** – *Energy Performance of Buildings. Common terms, definitions and symbols for the overall energy performance rating and certification*. They provide a coherent set of terms, definitions and symbols for concepts and physical quantities related to the overall energy performance of buildings and their components, including definitions of system boundaries.
- **EN 15603:2008** – *Energy performance of buildings. Overall energy use and definition of energy ratings*, and the corresponding **ISO/CD 16346:2011** – *Energy Performance of Buildings. Assessment of overall energy performance*. They provide definitions and allow to model data about *buildings*, *technical building systems*, *energy*, *energy ratings and certification*, *energy calculation*.
- **prEN O.A.:2012** – *Energy Performance of Buildings. Overarching standard EPBD.* It is intended to replace EN 15603:2008 and parts of other EN or EN-ISO standards published under the mandate M/343 on the EPBD. The standard covers the following topics: terminology and definitions, building and system boundaries, methodology for calculating the energy performance of a building and the set of input-output relations, performance indicators, etc.
- **EN 15217:2007** – *Energy performance of buildings. Methods for expressing energy performance and for energy certification of buildings*, and the corresponding **ISO/CD 16343:2011** – *Energy Performance of Buildings. Methods for expressing energy performance and for energy certification of buildings.* They provide definitions and allow to model data on the same topics of EN 15603:2008 and ISO/CD 16346:2011.
- **EN ISO 15927-1:2002** – *Hygrothermal performance of buildings. Calculation and presentation of climatic data. Part 1: Monthly and annual means of single meteorological elements.* The standard includes definitions of *climatic data*, useful for modelling them in the ontology structure.
- **EN ISO 13790:2008** – *Energy performance of buildings. Calculation of energy use*

for space heating and cooling. The standard provides definitions and terminology of several energy data, such as *time steps, periods and seasons*, *spaces, zones and areas*, *temperatures*, *energy*, *building heat transfer*, *building heat gains*, *building energy balance*.

- **EN 15316 (series)** – *Heating systems in buildings. Method for calculation of system energy requirements and system efficiencies.* The series of this standard provides data descriptions on space heating systems, space cooling systems, domestic hot water systems, etc. with the related technical subsystems.
- **ISO 13600 (series)** – *Technical energy systems.* The series of this standard can be used as tools to define, describe, analyse and compare technical energy systems at micro and macro levels.
- **ANSI/ASHRAE/IESNA Standard 90.1:2007** – *Energy Standard for Buildings Except Low-Rise Residential Buildings.* This standard allows to model data on energy quantities, energy systems and boundary conditions, providing definitions and relationships among concepts.

Other references on energy data modelling are supplied by several European projects:

- TABULA (*Typology Approach for Building Stock Energy Assessment*), 2009-2012.
- DATAMINE (*Collecting Data from Energy Certification to Monitor Performance Indicators for New and Existing buildings*), 2006-2008.
- REBECEE (*Renewable Energy and Building Exhibitions in Cities of the enlarged Europe*), 2006-2009.
- SMART-E BUILDINGS (*Smart-e buildings - yes we can enable the building sector to contribute to reaching the 3 x 20 objectives*), 2010-2013.
- ENERGY 21 (*Strategy for Energy Sustainability and Strengthening of the Planning of the Energy Use in Sustainable or Potentially Sustainable Municipalities*), 2007-2009.
- CASSANDRA (*A multivariate platform for assessing the impact of strategic decisions in electrical power systems*), 2011-2014.
- CITINES (*Design of a decision support tool for sustainable, reliable and cost-effective energy strategies in cities and industrial complexes*), 2011-2014.
- BEST Energy (*Built Environment Sustainability and Technology in Energy*).
- EnPROVE (*Energy consumption prediction with building usage measurements for software-based decision support*).
- International Energy Agency – Energy Conservation in Buildings & Community Systems (IEA – ECBCS), Annex 51 (*Energy Efficient Communities*), 2007-2011.
- International Energy Agency – Energy Conservation in Buildings & Community Systems (IEA – ECBCS), Annex 55 (*Reliability of Energy Efficient Building Retrofitting - Probability Assessment of Performance & Cost* – RAP-RETRO), 2009-2013.

Elaboration of the *Standard Tables*

A methodology to create a semantic structure from energy systems, energy quantities and boundary conditions data is described, starting from the definitions and the concept relationships provided by technical standards.

All the concepts (data) are structured in two components: the object (what the concept *is*) and the attributes (what the concept *has*). Following these rules, which are the foundations of formal concept analysis, some *Standard Tables* are elaborated. Each category of data (e.g.

"energy data", "building technical data" and "climatic data") could have one or more *Standard Tables* (or Excel sheets) according to the quantity of data to be modelled.

A *Standard Table* contains the following information:

- The name of the datum/concept (or the acronym, if different from the name provided in Deliverable 3.1), with the indication of the concept objects (*is*) and/or the attributes (*has*).
- The corresponding name included in Deliverable 3.1, or a new name if necessary (in this case, it is specified with "[new]").
- The description of the concept facilitated by the standards.
- The reference that provides the description (i.e. the title of the standard). An asterisk near the reference means that the description has been adapted according to the scope.
- The type of datum, if descriptive (e.g. *string*, *logical*), or numeric (e.g. *integer*, *real*, *date*).
- The unit, if applicable.
- The name of other sheets, or *Standard Tables*, in which the concept is further detailed.

Standard Table *template*

Name/Acronym			*Corresponding Name in D3.1*	*Description*	*Reference*	*Type of data (descriptive / numeric)*	*Unit*	*Reference to other sheets*
…								
has	…							
	is	…						
	is	…						
	is	…						

Modelling the available energy data

The first data from the case studies that have been semantically modelled are those necessary for developing Use Case 10, which has been chosen to design the demonstration scenarios to be implemented in the three case studies. The procedure of modelling data can be described in the following steps:

1. The first step is the data collection, which has been developed in Work Package 2.
2. The second step is the classification of data into categories (Task 3.1).
3. The third step is the definition of input data and outputs of the Activities of Use Case 10, including the input data from tools (Work Package 5).
4. The fourth step is the creation of the *Standard Tables*, structuring the data according to the analysed standards (Task 3.2, Task 3.3).
5. The fifth step is the transposition of the *Standard Tables* onto the *Ontology Editor*.[1]

The *Standard Tables* on "energy data", "building technical data" and "climatic data"

[1] The *Ontology Editor* being developed in Task 4.3 enables domain experts and ontology engineers to collaborate in the creation of an ontology as coded in *OWL DL-Lite*$_A$. The implementation of this tool is explained in Deliverable 4.3.

categories created for the demonstration scenarios are shown in Appendix A.

As all the data converge in a single structure, in order to keep a correspondence between the input data deriving from the data sources or from the tools and the data names of Deliverable 3.1, some intermediate *Mapping Tables* have been created, the mapping tables for data sources and the mapping tables for tools input data. The mapping tables are also useful for enabling multiple users to collaborate in the definition and maintenance of the ontology.

The template and some examples of the mapping tables are provided in Appendix B.

Conclusions

The present deliverable contributes to the development of the SEMANCO project insofar as: *a)* it presents guidelines for structuring and semantically modelling energy data, allowing the building of ontologies as the core of the SEMANCO project, *b)* it provides *Standard Tables* for structuring and modelling the data, and the *Mapping Tables* in order to create correspondence between the ontology and input data deriving from the data sources or from the tools.

The contribution of Task 3.2 and the present deliverable to the demonstration scenarios (Deliverable 8.1) is directly linked to the Use Case methodology. The *Standard Tables* allow to semantically structure all the data necessary to develop Use Case 10. Moreover, they allow the transposition of the data structure into the *Ontology Editor* (directly linked to the *Semantic Energy Information Framework*, SEIF).

The proposed methodology of data collection and structure is innovative both in the use and application of the references and in the elaboration of the *Standard Tables.* This work gives a substantial contribution to semantics, because new specific fields on energy topics are now available to be implemented in the ontology world.

The *Standard Tables* in Appendix A should not be considered exhaustive. More data fields could be added for each category if new data need to be structured.

1 INTRODUCTION

1.1 Purpose and target group

The approach of the SEMANCO project in developing and integrating ICT tools to reduce CO_2 emissions is based on four interrelated components (Figure 1):

- Supporting access to distributed and heterogeneous sources of energy data and energy-related data, and analysis of these sources.
- Semantic modelling of energy data, according to EU energy and ontological standards.
- Integrated tools, that access and update the semantically modelled data, based on new and existing IT solutions for decision making in the development of CO_2 reduction strategies.
- Requirements analysis to ensure that the tools and CO_2 reduction strategies developed address real world problems, within the SEMANCO demonstration cases and throughout the EU.

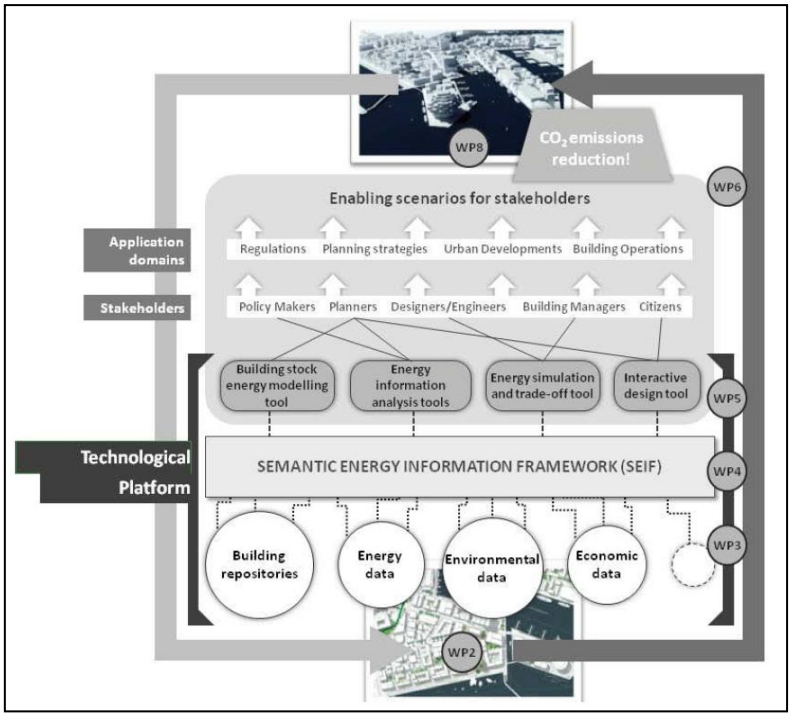

Figure 1. Methodological approach of SEMANCO[2]

The present deliverable, D3.2 – *Guidelines for structuring energy data*, has been developed within Work Package 3 (WP3) – *Energy data modelling* – of the SEMANCO project. WP3 concerns both the first and the second component of the previous list and is composed of the following four tasks:

- Task 3.1 – *Providing access to distributed energy data repositories.*
- Task 3.2 – *Structuring available data according to energy standards.*
- Task 3.3 – *Structuring contextual data according to standards.*

[2] Annex I- *Description of the Work*, Part B, p. 3.

- Task 3.4 – *Ontology Repository and Data migration to OWL format.*

In particular, Deliverable 3.2 summarises the work done and the results achieved in Task 3.2, which has the main objective of semantically modelling the energy data according to international standards.

The data were provided by Task 2.1–*Case study design*, in which the available data from the three case studies analysed in SEMANCO – Manresa (Spain), Newcastle-upon-Tyne (United Kingdom) and North Harbour (Denmark) – were collected and then listed in Deliverable 2.1 – *Report of the case studies and analysis*. In Task 3.1, the energy data were analysed and classified according to a categorisation, fixing the terminology and the definitions and including them in Deliverable 3.1.

Task 3.1 had a key role as connection node between Task 2.1 and Tasks 3.2 and 3.3. In fact, Tasks 3.2 and 3.3 provide the ontological modelling of data identified in Task 2.1 using the terminology defined in Task 3.1.

Task 3.2 and Task 3.3 are developed in parallel, because they both concern the data modelling but Task 3.2 is about the energy data (i.e. energy systems, energy quantities and boundary conditions), while Task 3.3 is concerned with the energy-related data or contextual data. The present deliverable provides the guidelines for structuring energy data, while Deliverable 3.3 (month 18) will contain the guidelines for structuring contextual data.

The development of the ontology is the basis for the creation of the SEIF (*Semantic Energy Information Framework*) in WP4. The SEIF facilitates access to distributed energy data for the tools developed in WP5. The semantic framework creates the required bridge between different domains and contents.

Deliverable 3.2 deals with the following issues:

- The identification of the categories of data to be semantically modelled according to a precise structure.
- The analysis of the main international standards for energy data modelling.
- The definition of the ontology structure and the creation of the *Standard Tables*.
- The elaboration of mapping tables to create correspondence between the ontology and input data deriving from the data sources or from the tools.

The *Standard Tables* for each data category concerning energy systems, energy quantities and boundary conditions are shown in Appendix A.

The *Mapping Tables* are provided in Appendix B.

1.2 Contribution of partners

The present deliverable is the result of the collaborative work done in Task 3.2. The following project partners have been involved: POLITO, FUNITEC, UoT, CIMNE and HAS. Deliverable 3.2 has been elaborated by POLITO, which is the leader both of Task 3.2 and of the entire WP3.

The information on data has been provided by the partners responsible for the case studies: RAMBOLL for North Harbour (Denmark), NEA and UoT for Newcastle-upon-Tyne (United Kingdom), and CIMNE and FORUM for Manresa (Spain).

The semantic modelling of data (*Standard Tables*) has been developed with the support of HAS. The mapping tables have been developed together with FUNITEC.

Detailed reviews of the deliverable were conducted by Leandro Madrazo and Álvaro Sicilia (FUNITEC) and German Nemirovskij (HAS) and the final version of the deliverable was proofread by Nina Dunlavy (NEA).

1.3 Relations to other activities in the project

As described in Deliverable 1.8, ontologies are the core of the SEMANCO project. Building an ontology requires the integration of vocabularies originating from different domains and used in different data sources, tools, by different user groups and stakeholders. The process of building an ontology therefore demands a multiple view approach of the different dimensions of the project development in order that the different perspectives involved can be integrated. To facilitate the integration of the different areas of the project, a methodology based on Use Cases has been adopted.

A Use Case is the bond connecting the tasks carried out in the different WPs, e.g. development of tools and integration of data sources. It also provides the bridge between the WPs and the demonstration scenarios. Each Use Case is composed of a network of Activities which need to be performed to fulfil the goal of the Use Case. Some of the Activities are shared by several Use Cases.

The role of Work Package 3 in the Use Case methodology involves the following activities:

- The identification of input data to fulfil the Activity goal in the Use Case (T3.1).
- The check of the technical accessibility of data sources (T3.1) to develop the Ontology Repository (T3.4).
- The semantic modelling of energy data (T3.2) and energy-related data (T3.3) according to technical standards.

In particular, the role of Task 3.2 (and Task 3.3) in the Use Case methodology is shown in Figure 2.

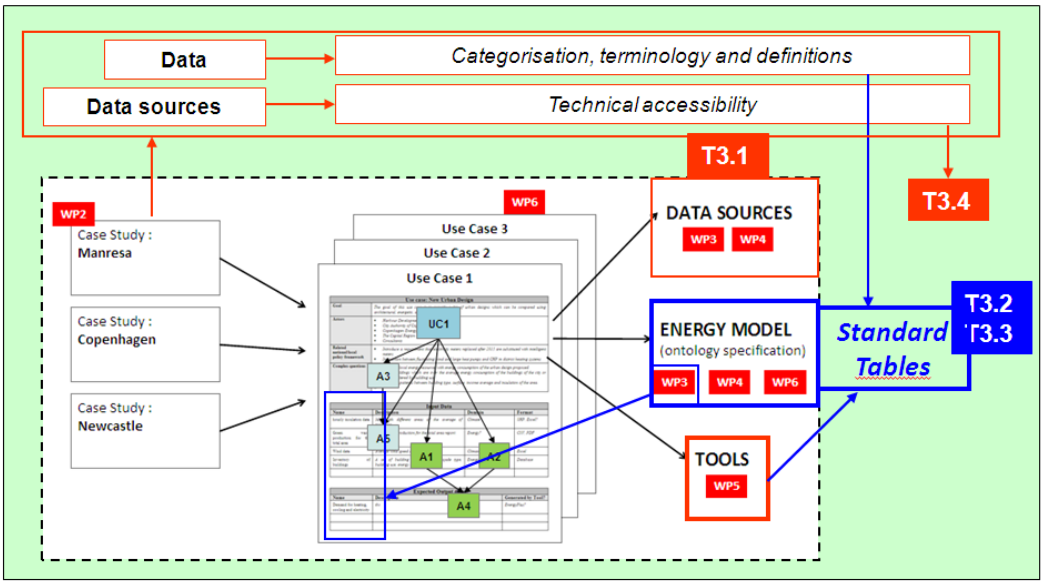

Figure 2. Role of Task 3.2 in the Use Case methodology

Task 3.2 gives a fundamental contribution to the development of the Use Case methodology because all the input data and the outputs in the Activities related to energy systems, energy quantities and boundary conditions have to be semantically modelled, and Deliverable 3.2 provides the guidelines to achieve this goal.

The main results of Task 3.2 are the *Standard Tables* in which the data are structured and defined according to technical standards. The description of the Activities refer to the *Standard Tables* (see Figure 3), which are developed starting from the data identified in WP2

and classified in Task 3.1 (see Figure 2).

Also the input data of tools, in addition to those of the case studies, need to be structured; for this reason, WP5 is connected to Task 3.2 (see Figure 2), and Deliverable5.1 –*Building extraction and classification tools* has been developed in parallel to Deliverable 3.2.

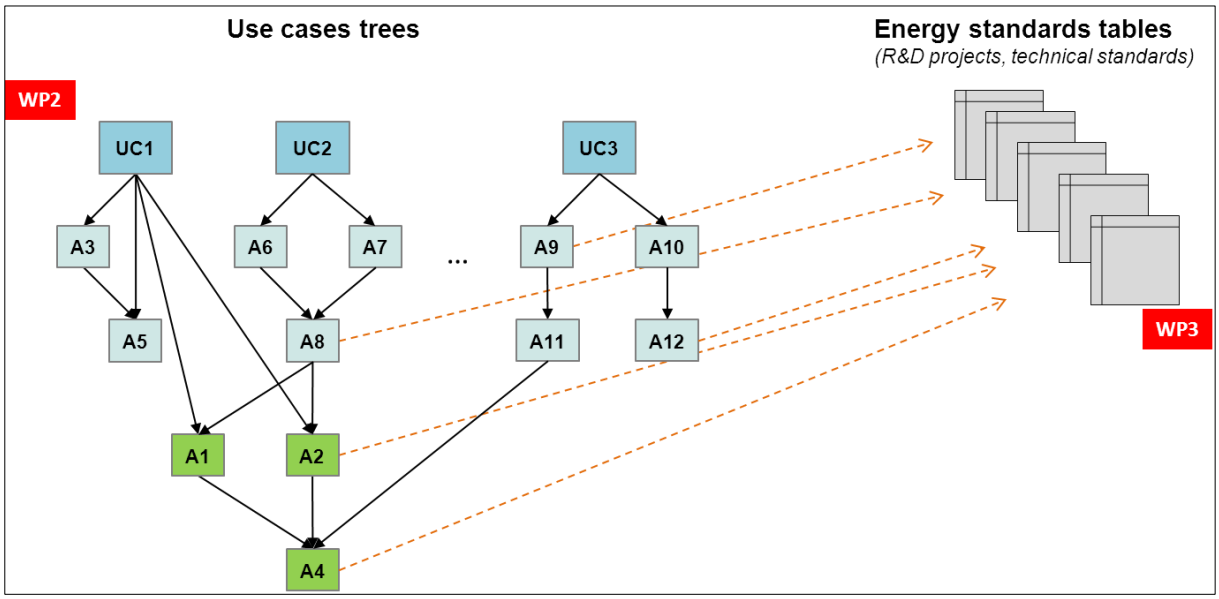

Figure 3. Relationship between Activities and Standard Tables (Task 3.2)

In turn Standard Tables serve as input for the specification of the Energy Model, a formally (i.e. in OWL) specified ontology, that plays the central role in the work of the Semantic Energy Information Framework (SEIF) being developed in WP4, Task 4.2 (Figure 2).

2 CLASSIFICATION OF ENERGY DATA

Because of the different origins and the wide numerical quantity of data necessary to develop an energy and environmental analysis at different scales, it was necessary to first collect data from case studies and then classify them into categories. This work was performed in Task 3.1. The data categories which were defined in Deliverable 3.1 are summarised in Table 1 with a brief description and some examples of data included in each category.

Table 1. Categories of data defined in D3.1

Category	**Description**	**Example of data**
ENERGY DATA	This category includes data referring to energy quantities.	Auxiliary energy, CO_2 emission coefficient, CO_2 emissions, delivered energy, energy demand (or energy required), energy supply, exported energy, final energy (or energy used), primary energy, produced renewable thermal/electric power/energy, RES coverage, etc.
ENERGY COST DATA	This category includes both energy cost and investment cost. The energy cost expresses the cost of each energy carrier. It could be the cost of the consumed energy, or the cost of the energy savings due to retrofit actions on the existing building stock, or the cost of the produced/exported energy. The investment cost might, for instance, refer to new constructions or to energy refurbishment actions.	Energy cost, investment cost, etc.
CLIMATIC DATA	This category includes the datasets that define the climatic conditions of a given geographical area.	Air temperature, diffuse solar irradiance, direct solar irradiance, global solar irradiance, gust wind speed, mixing ratio, rainfall total, reference wind speed, relative humidity, solar declination, solar irradiance, solar irradiation, water vapour pressure, wind direction, wind speed, etc.
ENVIRONMENTAL DATA	This category includes all the data that refer to the principal air pollutants in the urban area.	Total suspended particulate matter, sulphur dioxide, nitrogen dioxide, carbon monoxide, ozone, lead, etc.
BUILDING TECHNICAL DATA	This category includes data on building and its technical systems. It can be subdivided in several sub-categories, due to the wide range of data covered: *building general data*, *building external surroundings*, *building geometry*, *building construction*, *technical building systems*.	Building age, building typology, conservation state, building use, crowding index, occupancy profile, percentage of occupation, indoor air temperature (space heating), indoor air temperature (cooling), air exchange rate, internal heat gains, ground ρ-value, ground α-value, external obstructions, floor area, volume, height, orientation, thermal envelope area, number of complete storeys, number of apartments, shape factor, compactness ratio, building coordinates, type of <component>, number of <components>, <component> orientation, <component> adjoining space, <component> dimensions, <component> area, <component> percentage, <component> thickness, <component> U-value, type of system, type of subsystem, thermal/electrical power installed, efficiency, energy source, energy carrier, etc.

Category	Description	Example of data
LEGISLATIVE CONSTRAINTS	This category includes the data concerning legislative requirements specifying standards by which either new constructions or retrofits of existing buildings must abide.	[The legislative constraints refer to some quantities and parameters already described in the "energy data" and "building technical data" categories].
GEOGRAPHICAL DATA	This category refers to data included in the "Geographic Information System" (GIS). The delivered information by the GIS is usually classified in: *geometric data*, *topologic data*, *informative data*.	[Due to the different nature of the information provided by the GIS and the high quantity of data delivered by the system, the geographical data for each case study of SEMANCO are provided and classified through an identification code, which summarises different types of data].
LAND AND BUILDINGS REGISTRY DATA	This category includes the data referring to the cadastre, for different scales or levels of analysis. The land registry data can be divided into the following sub-categories: *land parcels*, *land tenure*, *land value*. The registry data of buildings is considered a parallel category of the land registry data.	*Land registry data*: location, boundaries, coordinates, total surface, built surface, property rights, ownership, leases, property regime, land quality, land classification, economic value, tax value, value of improvements, etc. *Buildings registry data*: number of buildings, cadastral reference, cadastral area, cadastral rooms, graphic information, owner, etc.
URBAN PLANNING DATA	Traditionally the data for urban planning came from the land register's land category or the building register's major usage. However, urban land data also consider, for instance, the land use (e.g. building land, or no-building land) and the area of activity data.	Land use, area of activity, planned buildings, planned communication ways, planned public facilities and utilities, etc.
SOCIO-ECONOMIC DATA	This category includes overall basic social and economic data. The following sub-categories can be considered: *housing*, *families and households*, *economic activity*, *income and poverty.*	Occupancy status, number of rooms, number of occupants, type of ownership, property price, social rented, private rented, rental, rental free, number of nuclear families, size of nuclear family, type of nuclear family, number of households, size of household, type of household, employment, unemployment, occupations, earnings, hours worked, income, poverty, etc.
DEMOGRAPHIC DATA	This category includes overall basic data on population characteristics. The following sub-categories can be considered: *population*, *learning and education*.	Size, gender, age, birth date, density, origin, nationality, religion, language, learning level, education level, etc.

In order to perform the subsequent data mining processes on the semantically modelled data, the information in this table will need to be supplemented with additional information, namely, data types and units of measure for all data items. For these purposes, the data categories described in the table will need to be further classified in these two groups:

- Energy systems, energy quantities and boundary conditions data (defined generally as "energy data" in the title of the present deliverable), which will be analysed in the following sections.
- Energy-related data or contextual data, which will be analysed in Deliverable 3.3.

The former group includes data that are essential to perform an energy and environmental analysis, while the latter group includes data that are related to energy but are not indispensable for carrying out an energy analysis.

The categories of data that belong to each group are shown in Table 2, with a specification on

the Task/Deliverable in which the data of each category have to be semantically modelled.

Table 2. Categories of data to be semantically modelled

Category	**Group**		**Task/Deliverable**
	DATA ON ENERGY SYSTEMS, ENERGY QUANTITIES AND BOUNDARY CONDITIONS	**ENERGY RELATED DATA**	
ENERGY DATA	x		T3.2/D3.2
ENERGY COST DATA		x	T3.3/D3.3
CLIMATIC DATA	x		T3.2/D3.2
ENVIRONMENTAL DATA		x	T3.3/D3.3
BUILDING TECHNICAL DATA	x		T3.2/D3.2
LEGISLATIVE CONSTRAINTS		x	T3.3/D3.3
GEOGRAPHICAL DATA		x	T3.3/D3.3
LAND AND BUILDINGS REGISTRY DATA		x	T3.3/D3.3
URBAN PLANNING DATA		x	T3.3/D3.3
SOCIO-ECONOMIC DATA		x	T3.3/D3.3
DEMOGRAPHIC DATA		x	T3.3/D3.3

3 STRUCTURE OF ENERGY DATA

3.1 Analysis of technical standards and of literature on energy data modelling

The ontological modelling of data has to be developed through a common and shared terminology. The definitions of terms and their conceptualisation are provided by the literature, and specifically by the international technical standards, which supply the correct terminology, the descriptions, the relationships among concepts and, if applicable, the symbols and the units of the defined quantities.

The main technical standards for structuring data on energy systems, energy quantities and boundary conditions are the following:

- ISO/IEC CD 13273-1:2012 – *Energy efficiency and renewable energy sources. Common international terminology. Part 1: Energy Efficiency.*
- ISO/IEC CD 13273-2:2012 – *Energy efficiency and renewable energy sources. Common international terminology. Part 2: Renewable Energy Sources.*
- CEN/TR 15615:2008 – *Explanation of the general relationship between various CEN standards and the Energy Performance of Buildings Directive (EPBD).*
- ISO/TR 16344:2011 – *Energy Performance of Buildings. Common terms, definitions and symbols for the overall energy performance rating and certification.*
- EN 15603:2008 – *Energy performance of buildings. Overall energy use and definition of energy ratings.*
- ISO/CD 16346:2011 – *Energy Performance of Buildings. Assessment of overall energy performance.*
- prEN O.A.:2012 – *Energy Performance of Buildings. Overarching standard EPBD.*
- EN 15217:2007 – *Energy performance of buildings. Methods for expressing energy performance and for energy certification of buildings.*
- ISO/CD 16343:2011 – *Energy Performance of Buildings. Methods for expressing energy performance and for energy certification of buildings.*
- EN ISO 15927-1:2002 – *Hygrothermal performance of buildings. Calculation and presentation of climatic data. Part 1: Monthly and annual means of single meteorological elements.*
- EN ISO 13790:2008 – *Energy performance of buildings. Calculation of energy use for space heating and cooling.*
- EN 15316 (series) – *Heating systems in buildings. Method for calculation of system energy requirements and system efficiencies.*
- ISO 13600 (series) – *Technical energy systems.*
- ANSI/ASHRAE/IESNA Standard 90.1:2007 – *Energy Standard for Buildings Except Low-Rise Residential Buildings.*

The standards **ISO/IEC CD 13273:2012 parts 1 and 2** contain transversal concepts and their definitions in the fields of energy efficiency (part 1) and renewable energy sources (part 2). The energy terms can be grouped in different sets, such as:

- *Energy*, that includes: energy source, primary energy, secondary energy, energy storage, energy loss, energy carrier, final energy, energy use, etc.
- *Energy management*, that includes: energy policy, energy target, etc.
- *Energy performance*, that includes: energy performance indicator, benchmarking, etc.
- *Energy efficiency*, that includes: energy efficiency improvement, energy efficient design, etc.
- *Energy demand*, that includes: energy demand, energy supply, etc.
- *Renewable energy*, that includes: bioenergy, hydro energy, marine energy, solar energy, geothermal energy.

In terminology work, three primary forms of concept relationships are considered, the *generic relation*, the *partitive relation* and the *associative relation*.

In the *generic relation*, subordinate concepts within the hierarchy inherit all the characteristics of the superordinate concept and contain descriptions of these characteristics which distinguish them from the superordinate (parent) and coordinate (sibling) concepts. An example of *generic relation* is shown in Figure 4.

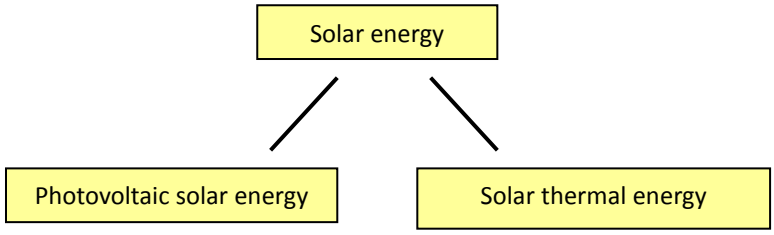

Figure 4. Example of generic relation *in ISO/IEC CD 13273-2*

In the formal specification of the energy model (Task 4.2) in this generic relation will be implemented as subsumption relation, such as:

$$\texttt{Photovoltaic\_Solar\_Energy} \sqsubseteq \texttt{Solar\_Energy}$$
$$\texttt{Solar\_Thermal\_Energy} \sqsubseteq \texttt{Solar\_Energy}$$

In the *partitive relation*, subordinate concepts within the hierarchy form constituent parts of the superordinate concept. An example of *partitive relation* is shown in Figure 5.

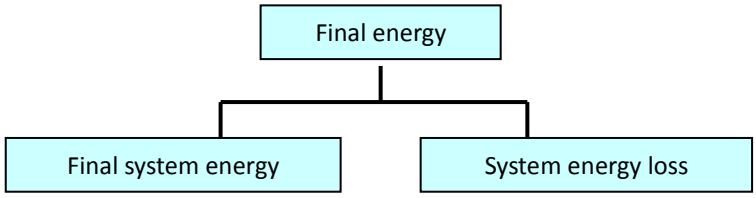

Figure 5. Example of partitive relation *in ISO/IEC CD 13273-1*

In the formal specification of the energy model (Task 4.2) each partitive relation between two concepts will be implemented by means of two axioms, for example:

$$\exists \texttt{hasFinal\_System\_Energy} \sqsubseteq \texttt{Final\_Energy}$$
$$\sqsubseteq \texttt{Final\_System\_Energy}$$

or

$$\exists \texttt{hasSystem\_Energy\_Loss} \sqsubseteq \texttt{Final\_Energy}$$
$$\sqsubseteq \texttt{System\_Energy\_Loss}$$

Through these formal specifications the energy model will be kept aligned with the formalism of the *DL-Lite*$_A$ developed to support semantic access to relational databases. This is an important requirement of the development of the Semantic Information Framework (SEIF).

The *associative relation* is helpful in identifying the nature of the relationship between one concept and another within a concept system (e.g. cause and effect, activity and location, tool and function, material and product, etc.). An example of *associative relation* is shown in Figure 6.

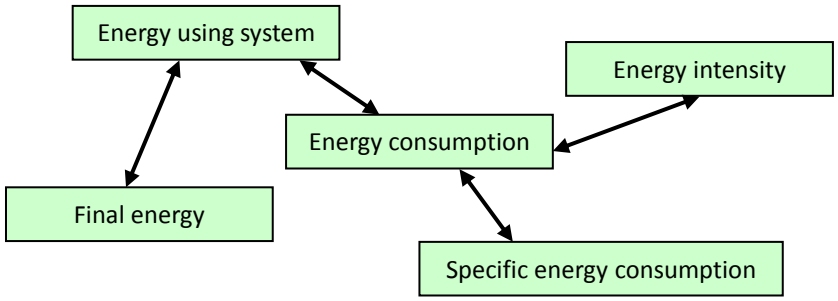

Figure 6. Example of associative relation *in ISO/IEC CD 13273-1*

The associative relation is the weakest relation between two concepts since the *DL-Lite*$_A$ specification cannot distinguish between partitive and associative relations. Therefore in the formal specification of the energy model to be performed in Task 4.2 only two of the formal relation descriptions shown in Figure 6 will be used.

The European Technical Report **CEN/TR 15615:2008** and the corresponding International Technical Report **ISO/TR 16344:2011** provide a coherent set of terms, definitions and symbols for concepts and physical quantities related to the overall energy performance of buildings and their components, including definitions of system boundaries. The terms and definitions are applicable to energy calculations and, in general, in the field of the energy performance of buildings and their components.

The European Standard **EN 15603:2008** and the corresponding International Standard **ISO/CD 16346:2011** specify a general framework for the assessment of overall energy use of a building, and the calculation of energy ratings in terms of primary energy, CO_2 emissions or parameters defined by national energy policy. The standards provide definitions and enable the modelling of data of *buildings* (e.g. building, technical building system, building services, space heating, space cooling, conditioned space, etc.), *technical building systems* (e.g. system thermal loss, recovered system thermal loss, etc.), *energy* (e.g. energy source, energy carrier, delivered energy, exported energy, renewable energy, primary energy, CO_2 emission coefficient, etc.), *energy ratings and certification* (e.g. energy rating, etc.), *energy calculation* (e.g. heat gains, etc.).

The **Overarching Standard EPBD** is intended to replace **EN 15603:2008** and parts of other EN or EN-ISO standards published under the mandate M/343 on the EPBD. The standard handles the framework of the overall energy performance of a building, covering the following topics: terminology and definitions, building and system boundaries, methodology for calculating the energy performance of a building and the set of input-output relations, general requirements to standards dealing with partial calculations, performance indicators, etc.

The European Standard **EN 15217:2007** and the corresponding International Standard **ISO/CD 16343:2011** set out ways of expressing the energy performance in an energy performance certificate of a building, and ways of expressing requirements as to the energy performance. It includes an overall numerical energy performance indicator and classes, against benchmarks. The standards provide definitions and allows to model data on the same topics of EN 15603:2008 and ISO/CD 16346:2011.

The standard **EN ISO 15927-1:2002** specifies procedures for calculating and presenting the monthly means of those parameters of climatic data needed to assess some aspects of the thermal and moisture performance of buildings. The standard includes definitions of *climatic data*, useful for modelling them in the ontology structure. The international standard covers the following single climate variables: air temperature, atmospheric humidity, wind speed, precipitation, solar radiation and long wave radiation.

The standard **EN ISO 13790:2008** specifies calculation methods for assessment of the annual energy use for space heating and cooling of a residential or a non-residential building, or a part of it. The method includes the calculation of:

a) the heat transfer by transmission and ventilation of the building zone when heated or cooled to constant internal temperature;

b) the contribution of internal and solar heat gains to the building heat balance;

c) the annual energy needs for heating and cooling, to maintain the specified set-point temperatures in the building – latent heat not included;

d) the annual energy use for heating and cooling of the building, using input from the relevant system standards.

This standard also provides the definitions and the terminology of several energy data, such as *time steps, periods and seasons* (e.g. heating or cooling season, etc.), *spaces, zones and areas* (e.g. conditioned space, unconditioned space, conditioned area, etc.), *temperatures* (e.g. internal temperature, external temperature, etc.), *energy* (e.g. energy need, technical building system, technical building subsystem, etc.), *building heat transfer*, *building heat gains* (e.g. internal heat gains, solar heat gains, etc.), *building energy balance*.

The series of European Standards **EN 15316** constitute a set of standards on calculation method for determining system energy requirements and system efficiencies of space heating systems and domestic hot water systems. The calculation method facilitates the energy analysis of the different sub-systems of the heating system, including control (emission, distribution, storage, generation), through determination of the system energy losses and the system performance factors. The modelling of data referred to technical building systems is covered by these standards, which provide data descriptions on space heating systems, space cooling systems, domestic hot water systems, etc. with the related technical subsystems. Terminology on renewable energy sources is also provided by these standards.

The series of International Standards **ISO 13600** can be used as tools to define, describe, analyse and compare technical energy systems at micro and macro levels. The technical energy system is defined as a *combination of equipment and plant interacting with each other to produce, consume or, in many cases transform, store or handle energyware*. A conceptual model is identified that divides the technosphere into two sectors: the energyware supply sector and the energyware demand sector. Each sector of the technosphere is made up of some subsectors and each subsector is made up of interrelated different technical energy systems (consolidation principle).

The **ANSI/ASHRAE/IESNA Standard 90.1:2007** provides minimum energy-efficient requirements for the design and construction of new buildings and their systems, new portions of buildings and their systems, and new systems and equipment in existing buildings. The Standard gives criteria for determining compliance with these requirements. The provisions of the Standard apply to the envelope of buildings and the following systems and equipment used in conjunction with buildings: heating, ventilating, air conditioning, service water heating, electric power distribution and metering provisions, electric motors and lighting.

The Standard allows to model data on energy quantities, energy systems and boundary conditions, providing definitions and relationships among concepts.

Other International Standards should be mentioned about data modelling of more specific topics under the group of energy systems, energy quantities and boundary conditions data:

- EN ISO 13789:2007 – *Thermal performance of buildings. Transmission and ventilation heat transfer coefficients. Calculation method.*
- EN ISO 10077-1:2006 – *Thermal performance of windows, doors and shutters. Calculation of thermal transmittance. Part 1: General.*
- EN ISO 13370:2007 – *Thermal performance of buildings. Heat transfer via the ground. Calculation methods.*

Other references on energy data modelling are supplied by the following projects developed within the "Intelligent Energy Europe" programme:

- TABULA (*Typology Approach for Building Stock Energy Assessment*), 2009-2012.
- DATAMINE (*Collecting Data from Energy Certification to Monitor Performance Indicators for New and Existing buildings*), 2006-2008.

TABULA aimed to create a harmonised structure for European building typologies. It provides terminology on building typologies with reference to the residential building stock. Definitions of geometrical data of building types, typical constructions and technical systems are provided for many European countries.

DATAMINE aimed to construct a knowledge base using the information on the energy performance certificates issued when buildings are constructed, sold or rented. The project offers a coherent structure of the uses in buildings, together with their description. The building uses defined in this project can be added to the list provided by the European Directive 2010/31/EU (EPBD recast, Annex I).

Other European and international projects can be mentioned as references:

- Intelligent Energy Europe
    - REBECEE (*Renewable Energy and Building Exhibitions in Cities of the enlarged Europe*), 2006-2009. The project aimed to promote renewable energy heating/cooling applications and energy efficiency solutions for buildings.
    - SMART-E BUILDINGS (*Smart-e buildings - yes we can enable the building sector to contribute to reaching the 3 x 20 objectives*), 2010-2013. The project aims to develop a platform where building owners, professionals and citizens can exchange experiences, ideas, and information, proactively supporting the Smart-e Buildings cause.
    - ENERGY 21 (*Strategy for Energy Sustainability and Strengthening of the Planning of the Energy Use in Sustainable or Potentially Sustainable Municipalities*), 2007-2009. The project consisted of developing a strategy to reach energy sustainability through the strengthening of the Local Agenda21 in the energy field.
- 7th Framework Programme – ICT projects
    - CASSANDRA (*A multivariate platform for assessing the impact of strategic decisions in electrical power systems*), 2011-2014. The project aims to create the aggregation methodology and the framework of key performance indicators for scenario assessment, and an expandable software platform that provides different energy stakeholders with the ability to model the energy market, in order to assess scenarios for their own purposes.
    - CITINES (*Design of a decision support tool for sustainable, reliable and cost-effective energy strategies in cities and industrial complexes*), 2011-2014. The

project aims to design and develop a multi-scale multi-energy decision-making tool to optimise the energy strategy of cities or large industrial complexes by enabling them to define sustainable, reliable and cost-effective long-term energy plans.

- 7° Framework Programme – ICT4e2b Projects
    - BEST Energy (*Built Environment Sustainability and Technology in Energy*).
    - EnPROVE (*Energy consumption prediction with building usage measurements for software-based decision support*).
- International Energy Agency – Energy Conservation in Buildings & Community Systems (IEA – ECBCS)
    - Annex 51 (*Energy Efficient Communities*), 2007-2011. The project covers the design of long-term energy conservation and greenhouse gas (GHG) mitigation strategies and their continuous optimisation either on a community level or on the level of a municipal quarter.
    - Annex 55 (*Reliability of Energy Efficient Building Retrofitting - Probability Assessment of Performance & Cost* – RAP-RETRO), 2009-2013. The project aims to develop and provide decision support data and tools for energy retrofitting measures. The main objective of the project is the collection and the analysis of data in order to create stochastic data sets.

Other references of terminology are calculation procedures, for instance the Standard Assessment Procedure (SAP). The SAP is the UK Government's recommended method system for measuring the energy rating of residential dwellings. This methodology will be applied in SEMANCO in the demonstration scenario of Newcastle.

3.2 Elaboration of the *Standard Tables*

In the present section, a methodology to semantically structure energy systems, energy quantities and boundary conditions data is described, starting from the definitions and the concept relationships provided by technical standards.

All the concepts (data) are structured according to two components: objects and attributes.

Each concept is defined through an object that specifies what the concept *is*. For instance, *human gender* is a concept that can be defined through objects, the *male* and the *female*. In this way, the *human gender is male* or the *human gender is female*.

Each concept can also be defined through a property, which is an attribute of the concept (i.e. the concept *has*). For instance, *building* is a concept that have many properties, like *use*, *geometry*, etc. In this way, the *building has use*, the *building has geometry*, and so on. In addition, the *use* is a concept and it can be described through objects, like *residential*, *office*, *commercial*, etc.

Following these rules, which are the foundations of formal concept analysis, some *Standard Tables* are elaborated in the form of Excel sheets. Each category of data (e.g. "energy data", "building technical data" and "climatic data") could have one or more *Standard Tables* (or Excel sheets) according to the quantity of data to be modelled.

The *Standard Table* template is shown in Table 3. It contains the following information:

- The name of the datum/concept (or the acronym, if different from the name provided in Deliverable 3.1).
- The corresponding name included in Del. 3.1, or a new name if necessary (in this case, it is specified with "[new]").

- The description of the concept, resulting from the standards.
- The reference that provides the description (i.e. the title of the standard). An asterisk near the reference means that the description has been adapted according to the scope.
- The type of datum, if descriptive (e.g. *string*, *logical*), or numeric (e.g. *integer*, *real*, *date*).
- The unit, if applicable.
- The name of other sheets, or *Standard Tables*, in which the concept is further detailed.

Table 3. Standard Table *template*

Name/Acronym			Corresponding Name in D3.1	Description	Reference	Type of data (descriptive / numeric)	Unit	Reference to other sheets
…								
has	…							
	is	…						
	is	…						
	is	…						

Besides the name of the datum, the first column of the *Standard Table* includes the concept objects (*is*) and/or the attributes (*has*). An example of the *building* concept (extract) is provided in Table 4.

Table 4. Example of Standard Table. *The concept relationships are provided in the first column*

Name/Acronym			Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
Building			-	construction as a whole, including its envelope and all technical building systems, for which energy is used to condition the indoor climate, to provide domestic hot water and illumination and other services related to the use of the building	EN 15603	-	-	-
has	**Age**		*building age*	construction period of the building	-	string	-	-
	is	**Year_Of_Construction**	-	year of construction of the building	-	string	-	-
	is	**Age_Class**	*building age class* [new]	period of years to be defined according to typical construction or building properties (materials, construction principles, building shape, …)	TABULA	string	-	-
		has **From_Year**	-	first year of the age class	TABULA	string	-	-
		has **To_Year**	-	last year of the age class	TABULA	string	-	-
		has **Allocation**	-	specification of the region the age class is defined for	TABULA	string	-	-
		has **Identifier**	-	-	SUMO	A,B,C,D	-	-
has	**Address**		*building address* [new]	address of the building	-	string	-	-
has	**First_Part_Of_Postcode**		*building postcode* [new]	first part of the postcode of the building location	SAP	string	-	-
has	**Building_Typology**		*building typology*	building typology	-	string	-	-
	is	**Flat**	-	apartment in a building	-	string	-	-
	is	**Detached_Building**	-	small building, without attached buildings	TABULA	string	-	-
	is	**Semi-Detached_Building**	-	small building, with an attached building	TABULA	string	-	-
	is	**Terraced_Building**	-	small building, with two attached buildings	TABULA	string	-	-
	is	**Row_Building**	-	big building, with prevalent horizontal extension	TABULA	string	-	-
	is	**Tower_Building**	-	big building, with prevalent vertical extension	TABULA	string	-	-
	is	**Courtyard_Building**	-	big building having "L" or "U" shape	TABULA	string	-	-

4 MODELLING THE AVAILABLE ENERGY DATA

The flowchart in Figure 7 shows the procedure that leads to the semantic modelling of the available data of the case studies concerning energy systems, energy quantities and boundary conditions. The first data modelled are those necessary for developing Use Case 10, which has been chosen to design the demonstration scenarios to be implemented in the three case studies. Use Case 10 provides a generic aim which has been assumed by all case studies: "To calculate the energy consumption, CO_2 emissions, costs and /or socio-economic benefits of an urban plan for a new or existing development".

The procedure can be described in the following steps:

1. The first step is the data collection, which has been developed in WP2. The available data and data sources were identified for each case study.
2. The second step is the classification of data into categories and the identification of their characteristics (T3.1). The technical accessibility of the data sources has also been checked (T3.1).
3. The third step is the definition of input data and outputs of the Activities of Use Case 10, using the terminology fixed in D3.1. In addition, the input data from both actual and embedded tools used in the SEMANCO platform (WP5) also have to be included in the ontology structure.
4. The fourth step is the creation of the *Standard Tables*, structuring the data according to the analysed standards (T3.2, T3.3).
5. The fifth step is the transposition of the *Standard Tables* into the *Ontology Editor*, that allows a direct link to the *Semantic Energy Information Framework* (SEIF) which facilitates access to distributed energy data for the tools (WP4). In this step data informally specified in the *Standard Tables* will be converted into formalisms described in section 3.1 of this document.

The *Standard Tables* on "energy data", "building technical data" and "climatic data" categories created for the demonstration scenarios are shown in Appendix A.

As all the data converge in a single structure, in order to keep a correspondence between the input data deriving from the data sources or from the tools and the data names of Deliverable 3.1, some intermediate *Mapping Tables* have been created. These tables are also useful for enabling multiple users to collaborate in the definition and maintenance of the ontology.

Two different *Mapping Tables* have been defined:

- Mapping tables for data sources.
- Mapping tables for tools input data.

The tables for data sources include, for each case study:

- The data source name.
- The name of the datum in the data source.
- The corresponding name of the datum in Del. 3.1.
- The data category in which the datum is included, according to Del. 3.1.

The tables for tools input data include, for each tool:

- The name of the tool.

- The name of the datum in the tool.
- The corresponding name of the datum in Del. 3.1.
- The data category in which the datum is included, according to Del. 3.1.

The template and some examples of the mapping tables are provided in Appendix B.

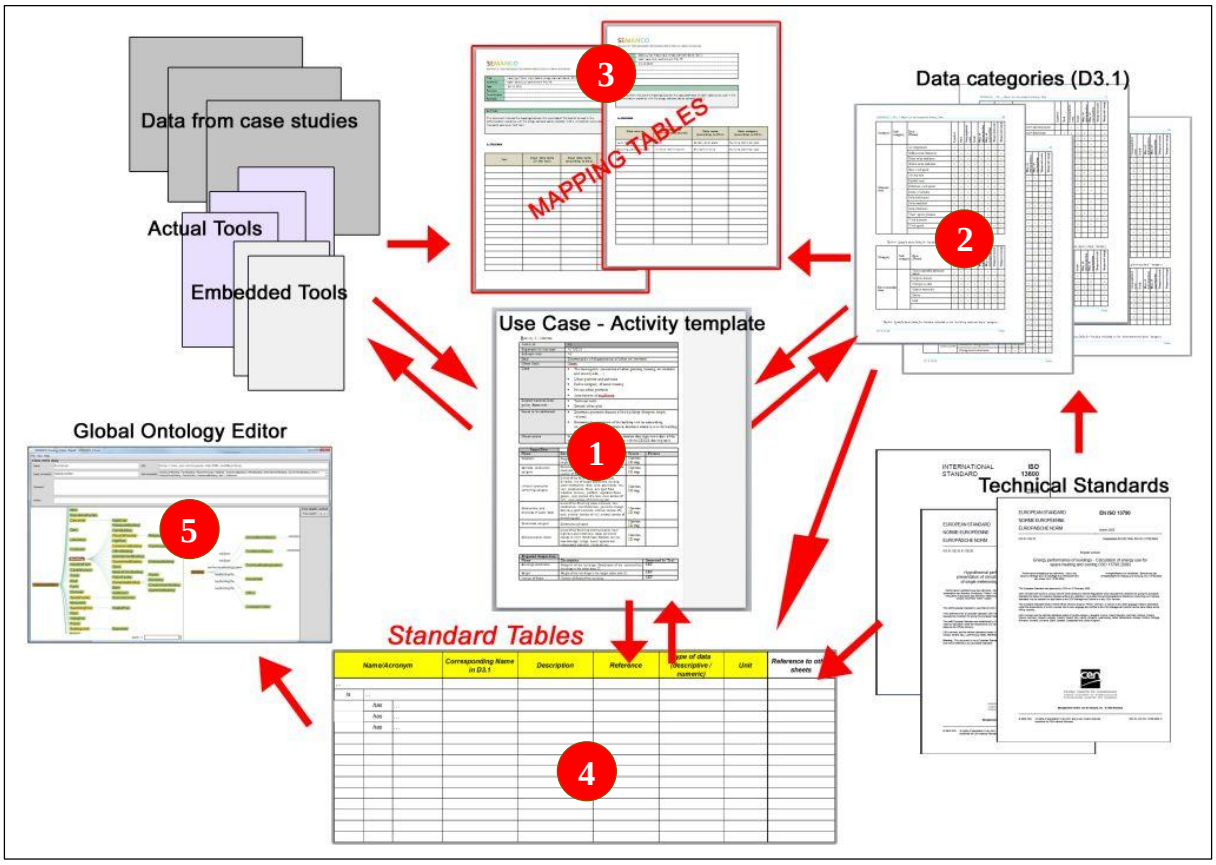

Figure 7. Flowchart of the procedure leading to the semantic modelling of data

5 CONCLUSIONS

5.1 Contribution to overall picture

The present deliverable, carried out in Task 3.2 of Work Package 3, contributes to the development of SEMANCO insofar as:

- It presents guidelines for structuring and semantically modelling energy data, allowing the building of ontologies as the core of the SEMANCO project. Some technical standards and European projects are presented as the main references for carrying out the ontological work.
- It provides the *Standard Tables* for structuring and modelling the data, and the mapping tables in order to create correspondence between the ontology and input data deriving from the data sources or from the tools.

5.2 Impact on other WPs and Tasks

Task 3.2 and Deliverable 3.2 have the following impacts on the other WPs and tasks of SEMANCO:

- They contribute to create a standard energy model, i.e. the ontology building the heard of the *Semantic Energy Information Framework* (SEIF) being developed in Work Package 4. The standard tables provided by Deliverable 3.2 are an input for the development of the formally specified ontology using the *Ontology Editor* being developed in the task 4.2.
- The standard energy model is also the basis for the application of the mapping tools developed in Task 4.1 and applied in Task 4.5 whose aim is to convert relational data to RDF and to integrate heterogeneously structured data sources to SEIF.
- The creation of the *Standard Tables* has contributed to the harmonization and enhancement of the previously defined Use Cases and Activities.

5.3 Contribution to demonstration

The contribution of Task 3.2 and the present deliverable to the demonstration scenarios (see also Deliverable 8.1) is directly linked to the Use Case methodology.

As the work conducted in Task 3.2 is mainly focused on the semantic modelling of data about energy systems, energy quantities and boundary conditions, the further impact of this task in the demonstration concerns:

- The elaboration of the *Standard Tables*, structuring both the “data names” of the Activity forms of the Use Case 10 and the input data from tools to be used in the SEMANCO platform (WP5).
- The elaboration of the mapping tables to keep a link between the original data names in the data sources/tools and the data names of Deliverable 3.1 and the ontology.

5.4 Other conclusions and lessons learned

The present deliverable provides guidelines for structuring energy data through the application of rules, terminology, concept relationships that are derived from different standards. The proposed methodology of data collection and structure is innovative both in the use and application of the references and in the elaboration of the *Standard Tables*.

This work gives a substantial contribution to semantics, because new specific fields on energy

topics are now available to be implemented in the ontology world.

The *Standard Tables* in Appendix A should not be considered exhaustive. More data fields could be added for each category if new data need to be structured.

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7 GLOSSARY

Building energy system

The building is considered as an energy system which includes the building's users and relevant components, such as the envelope and all the technical building systems, and for which energy is used to condition the indoor climate, to provide domestic hot water, illumination and other services related to the use of the building. The building interacts with the external environment through the system boundary which is crossed by different energy flows.

System boundary

Boundary that includes within it all areas associated with the building (both inside and outside the building) where energy is consumed or produced.

Standard table

Set of semantically structured concepts, including objects, attributes and standard definitions.

Mapping table

Correspondences between the ontology concepts and the data obtained from data sources or from software tools.

8 APPENDICES

APPENDIX A. Standard Tables on energy data

The *Standard Tables* on energy systems, energy quantities and boundary conditions data created for the demonstration scenarios are shown in the following subsections of Appendix A split by data category.

A.1 Energy data category

Table A1. Standard Table *referred to the Excel sheet named "energy_quantities"*

Name/Acronym			Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
Energy_Quantities_Related_To_Conditioned_Space			-	energy referred to building conditioned space	-	-	-	-
is	**Building_Heat_Transfer**		*building heat transfer* [new]	heat flow rate due to the difference between the temperature in the conditioned space and the temperature of the environment at the other side (in the case of transmission) or the supply air temperature (in the case of ventilation).	EN ISO 13790*	real	J Wh kWh/m^2 ….	-
	is	**Heat_Transfer_By_Transmission**	*heat transfer by transmission* [new]	heat flow rate due to thermal transmission through the envelope of a building	EN ISO 13790*	real	J Wh kWh/m^2 ….	-
	is	**Heat_Transfer_By_Ventilation**	*heat transfer by ventilation* [new]	heat flow rate due to air entering a conditioned space, either by infiltration or ventilation	EN ISO 13790*	real	J Wh kWh/m^2 ….	-
is	**Building_Heat_Gain**		*building heat gains* [new]	heat generated within, or entering into, the conditioned space from heat sources other than energy intentionally utilized for heating, cooling or domestic hot water preparation	EN ISO 13790	real	J Wh kWh/m^2 ….	-
	is	**Solar_Heat_Gain**	*solar heat gains* [new]	heat provided by solar radiation entering, directly or indirectly (after absorption in building elements), into the building through windows, opaque walls and roofs, or passive solar devices such as sunspaces, transparent insulation and solar walls	EN ISO 13790	real	J Wh kWh/m^2 ….	-
	is	**Internal_Heat_Gain**	*internal heat gains* [new]	heat provided within the building by occupants (sensible metabolic heat) and by appliances such as domestic appliances, office equipment, etc., other than energy intentionally provided for heating, cooling or hot water preparation	EN ISO 13790	real	J Wh kWh/m^2 ….	-

Name/Acronym			Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
is	**Energy_Need**		*energy need* [new]	heat to be delivered to or extracted from a conditioned space to maintain the intended temperature conditions during a given period of time or heat to be delivered to the needed amount of domestic hot water to raise its temperature from the cold network temperature to the prefixed delivery temperature at the delivery point	ISO TR 16344 EN 15603	real	J Wh kWh/m^2 ….	-
has	**Time_Aggregation_Period**		-	period to which the aggregation for the determination of the value refers	-	string	-	**"TIME"**
has	**Period**		-	time to which the value refers	-	string	-	**"TIME"**
Energy_Quantities_Related_To_Technical_Building_System			-	energy referred to the technical building systems	-	-	-	-
is	**System_Thermal_Loss**		*system thermal loss* [new]	thermal loss from a technical building system for heating, cooling, domestic hot water, humidification, dehumidification or ventilation that does not contribute to the useful output of the system	ISO TR 16344 EN 15603	real	J Wh kWh/m^2 ….	-
is	**Recovered_System_Thermal_Loss**		*recovered system thermal loss* [new]	part of the recoverable system thermal loss which has been recovered to lower either the energy need for heating or cooling or the energy use of the heating or cooling system	ISO TR 16344 EN 15603	real	J Wh kWh/m^2 ….	-
is	**System_Energy_Input**		*system energy input* [new]	energy entering the technical building system	-	real	J Wh kWh/m^2 ….	-
is	**Auxiliary_Energy**		*auxiliary energy*	electrical energy used by technical building systems for heating, cooling, ventilation and/or domestic water to support energy transformation to satisfy energy needs	ISO TR 16344 EN 15603 CEN/TR 15615	real	J Wh kWh/m^2 ….	-
has	**Time_Aggregation_Period**		-	period to which the aggregation for the determination of the value refers	-	string	-	**"TIME"**
has	**Period**		-	time to which the value refers	-	string	-	**"TIME"**
Energy_Consumption_And_Energy_Saving_Related_To_Building_Services			-	energy referred to building services	-	string	-	-
is	**Energy_Consumption**		-	quantity of energy applied	ISO/IEC CD 13273-1	string	-	-
is	**Energy_Saving**		-	reduction of energy consumption following implementation of an end-use action intented to improve energy performance	ISO/IEC CD 13273-1	string	-	-
has	**Energy_Quantities_And_Emissions**		-	-	-	-	-	-
	is	**Delivered_Energy**	*delivered energy*	energy, expressed per energy carrier, supplied to the technical building systems through the system boundary, to satisfy the uses taken into account (heating, cooling, ventilation, domestic hot water, lighting, appliances etc.) or to produce electricity	ISO TR 16344 EN 15603	real	J Wh kWh/m^2 ….	-

Name/Acronym					Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
		is	**Final_Energy**		*final energy*	the total purchased energy (fossil, electric) excluding renewables consumed to achieve the required building performance and comfort over a given period of time	ISO TR 16344	real	J Wh kWh/m^2 ….	-
	is	**Exported_Energy**			*exported energy*	energy, expressed per energy carrier, delivered by the technical building systems through the system boundary and used outside the system boundary	ISO TR 16344 EN 15603	real	J Wh kWh/m^2 ….	-
	is	**Primary_Energy**			*primary energy*	energy that has not been subjected to any conversion or transformation process	ISO TR 16344 EN 15603 ISO/IEC CD 13273-1	real	J Wh kWh/m^2 ….	-
	is	**Produced_Renewable_Energy**			*produced renewable energy*	energy produced by technical building systems using renewable energy sources, which are not depleted by extraction	ISO TR 16344*	real	J Wh kWh/m^2 ….	-
		is	**Produced_Renewable_Thermal_Energy**		*produced renewable thermal energy*	thermal energy produced by technical building systems using renewable energy sources, which are not depleted by extraction	ISO TR 16344*	real	J Wh kWh/m^2 ….	-
		is	**Produced_Renewable_Electrical_Energy**		*produced renewable electrical energy*	electrical energy produced by technical building systems using renewable energy sources, which are not depleted by extraction	ISO TR 16344*	real	J Wh kWh/m^2 ….	-
	is	**CO2_Emissions**			*CO_2 emissions*	for a given energy carrier, quantity of CO_2 emitted to the atmosphere	ISO TR 16344* EN 15603* CEN/TR 15615*	real	g ….	-
	has	**Energy_Carrier**			*energy carrier*	substance or phenomenon that can be used to produce mechanical work or heat or to operate chemical or physical processes	ISO TR 16344 ISO 13600	string	-	-
		is	**Electricity**		-	-	-	string	-	-
		is	**Natural_Gas**		-	-	-	string	-	-
		is	**Heat**		-	-	-	string	-	-
		is	**Gasoil**		-	-	-	string	-	-
		is	**Coal**		-	-	-	string	-	-
		has	**CO2_Emission_Coefficient**		*CO_2 emission coefficient*	for a given energy carrier, quantity of CO_2 emitted to the atmosphere per unit of delivered energy	ISO TR 16344 EN 15603 CEN/TR 15615	real	g/kWh ….	-
	has	**Energy_Source**			*energy source*	source from which useful energy can be extracted or recovered either directly or by means of a conversion or transformation process	ISO TR 16344	string	-	-
		is	**Not-Renewable_Energy_Source**		-	not-renewable energy source	-	string	-	-
			is	**Gasfields**	-	-	-	string	-	-
			is	**Oilfields**	-	-	-	string	-	-
			is	**Coal_Mines**	-	-	-	string	-	-

Name/Acronym					Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
		is	**Renewable_Energy_Source**		-	renewable energy source	-	string	-	-
			is	**Sun**	-	-	-	string	-	-
			is	**Wind**	-	-	-	string	-	-
			is	**Water_Power**	-	-	-	string	-	-
			is	**Geothermal**	-	-	-	string	-	-
			is	**Biomass**	-	-	-	string	-	-
	has	**Energy_Services**			*energy services*	related to the services provided by the technical building systems and by appliances to provide the indoor climate condition, illumination and other services related to the use of the building	UNI TR 16344* EN 15603*	string	-	-
		has	**Space_Heating**		*space heating*	process of heat supply for thermal comfort	UNI TR 16344 EN 15603	string	-	-
		has	**Space_Cooling**		*space cooling*	process of heat extraction for thermal comfort	UNI TR 16344 EN 15603	string	-	-
		has	**Domestic_Hot_Water**		*domestic hot water*	process of heat supply to raise the temperature of the cold water to the intended delivery temperature	UNI TR 16344* EN 15603*	string	-	-
		has	**Ventilation**		*ventilation*	process of supplying or removing air by natural or mechanical means to or from a space	UNI TR 16344 EN 15603	string	-	-
		has	**Lighting**		*lighting*	process of supplying the necessary illumination	UNI TR 16344 EN 15603	string	-	-
		has	**Electrical_Appliances**		*other services*	services supplied by energy consuming appliances	UNI TR 16344 EN 15603	string	-	-
		has	**Cooking**		*cooking* [new]	process of food preparation	-	string	-	-
	has	**Time_Aggregation_Period**			-	period to which the aggregation for the determination of the value refers	-	string	-	**"TIME"**
	has	**Period**			-	time to which the value refers	-	string	-	**"TIME"**
Energy_Indicator					-	indicator of building energy performance	-	-	-	-
is	**Energy_Performance_Indicator**				*energy performance indicator* [new]	energy rating divided by conditioned area	EN 15217	real	kWh/m^2	-
is	**Renewable_Energy_Sources_Coverage**				*RES coverage*	the ratio of the energy demand covered by renewable energy sources to the total energy required by an energy service	-	real	%	-
is	**…**									

A.2 Climatic data category

Table A2. Standard Table *referred to the Excel sheet named "climate"*

Name/Acronym						Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
Climate						-	climatic data	-	-	-	-
has	**Climatic_Parameter**					-	climatic parameter	-	-	-	-
	is	**Air_Temperature**				*air temperature*	the temperature of external air	EN ISO 15927-1	real	°C	-
	is	**Solar_Irradiance**				-	radiation power per area generated by the reception of solar radiation on a plane	EN ISO 15927-1*	real	W/m^2	-
		has	**Solar_Irradiance_Type**			-	type of solar irradiance	-	string	-	-
			is	**Direct_Solar_Irradiance**		*direct solar irradiance*	irradiance generated by the reception of solar radiation on a plane from a conical angle which surrounds concentrically the apparent solar disk	EN ISO 15927-1*	string	-	-
			is	**Diffuse_Solar_Irradiance**		*diffuse solar irradiance*	irradiance generated by the reception of scattered solar radiation from the full sky hemisphere on a plane, with the exception of that solid angle which is used to measure the direct solar irradiance	EN ISO 15927-1*	string	-	-
			is	**Global_Solar_Irradiance**		*global solar irradiance*	irradiance generated by reception of solar radiation from the full hemisphere on a plane	EN ISO 15927-1*	string	-	-
		has	**Solar_Irradiance_On_Surface_Type**			-	type of solar irradiance by type of surface on which the solar radiation is received	-	string	-	-
			is	**Solar_Irradiance_On_Horizontal_Surface**		-	radiation power per area generated by the reception of solar radiation on a horizontal plane	EN ISO 15927-1*	string	-	-
			is	**Solar_Irradiance_On_Not-Horizontal_Surface**		*solar irradiance*	radiation power per area generated by the reception of solar radiation on a plane of any tilt and orientation	EN ISO 15927-1	string	-	-
				has	**Orientation**	*orientation* [new]	the direction an envelope element faces, i.e. the direction of a vector perpendicular to and pointing away from the surface outside of the element	ANSI/ASHRAE 90.1	string	-	**"SPACE"**
	is	**Solar_Irradiation**				-	radiant energy per area received on a surface during a given period of time	EN ISO 15927-1*	real	MJ/m^2	-
		has	**Solar_Irradiation_Type**			-	type of solar irradiation	-	string	-	-
			is	**Direct_Solar_Irradiation**		*direct solar irradiation* [new]	irradiation generated by the reception of solar radiation on a plane from a conical angle which surrounds concentrically the apparent solar disk	EN ISO 15927-1*	string	-	-
			is	**Diffuse_Solar_Irradiation**		*diffuse solar irradiation* [new]	irradiation generated by the reception of scattered solar radiation from the full sky hemisphere on a plane, with the exception of that solid angle which is used to measure the direct solar irradiation	EN ISO 15927-1*	string	-	-
			is	**Global_Solar_Irradiation**		*global solar irradiation* [new]	irradiation generated by reception of solar radiation from the full hemisphere on a plane	EN ISO 15927-1*	string	-	-
		has	**Solar_Irradiation_On_Surface_Type**			-	type of solar irradiation by type of surface on which the solar radiation is received	-	string	-	-
			is	**Solar_Irradiation_On_Horizontal_Surface**		-	radiant energy per area received on a horizontal surface during a given period of time	EN ISO 15927-1*	string	-	-
			is	**Solar_Irradiation_On_Not-Horizontal_Surface**		*solar irradiation*	radiant energy per area received on a surface of defined inclination and orientation during a given period of time	EN ISO 15927-1	string	-	-
				has	**Orientation**	*orientation* [new]	the direction an envelope element faces, i.e. the direction of a vector perpendicular to and pointing away from the surface outside of the element	ANSI/ASHRAE 90.1	string	-	**"SPACE"**

Name/Acronym			Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
	is	**Solar_Declination**	*solar declination*	the angle between the equatorial plane and the straight line joining the centre of the Earth and the Sun	-	real	°	-
	is	**Wind_Speed**	*wind speed*	the speed of the wind	EN ISO 15927-1	real	m/s	-
	is	**Wind_Direction**	*wind direction*	the wind direction measured clockwise from North	EN ISO 15927-1	real	°	-
	is	**Relative_Humidity**	*relative humidity*	ratio of the vapour pressure of moist air to the vapour pressure it would have if it were satured	EN ISO 15927-1	real	%	-
	is	**Water_Vapour_Pressure**	*water vapour pressure*	part of the total atmospheric pressure exerted by water vapour	EN ISO 15927-1	real	hPa	-
	is	**Mixing_Ratio**	*mixing ratio*	ratio of the mass of water vapour to the mass of dry air with which the water vapour is associated	EN ISO 15927-1	real	g/kg	-
	is	**Rainfall_Total**	*rainfall total*	equivalent amount of melted solid precipitation	EN ISO 15927-1	real	mm	-
has	**Scale**		-	level of application	-	string	-	**"SPACE"**
has	**Time_Aggregation_Type**		-	type of time aggregation for the determination of the value	-	string	-	**"TIME"**
has	**Time_Aggregation_Period**		-	period to which the aggregation for the determination of the value refers	-	string	-	**"TIME"**
has	**Period**		-	time to which the value refers	-	string	-	**"TIME"**

A.3 Building technical data category

Table A3. Standard Table *referred to the Excel sheet named "building"*

Name/Acronym				Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
Building				-	construction as a whole, including its envelope and all technical building systems, for which energy is used to condition the indoor climate, to provide domestic hot water and illumination and other services related to the use of the building	EN 15603	-	-	-
has	**Age**			*building age*	construction period of the building	-	string	-	-
	is	**Year_Of_Construction**		-	year of construction of the building	-	string	-	-
	is	**Age_Class**		*building age class* [new]	period of years to be defined according to typical construction or building properties (materials, construction principles, building shape, ...)	TABULA	string	-	-
		has	**From_Year**	-	first year of the age class	TABULA	string	-	-
		has	**To_Year**	-	last year of the age class	TABULA	string	-	-
		has	**Allocation**	-	specification of the region the age class is defined for	TABULA	string	-	-
		has	**Identifier**	-	-	SUMO	A,B,C,D	-	-
has	**Address**			*building address* [new]	address of the building	-	string	-	-
has	**First_Part_Of_Postcode**			*building postcode* [new]	first part of the postcode of the building location	SAP	string	-	-
has	**Building_Typology**			*building typology*	building typology	-	string	-	-
	is	**Flat**		-	apartment in a building	-	string	-	-
	is	**Detached_Building**		-	small building, without attached buildings	TABULA	string	-	-
	is	**Semi-Detached_Building**		-	small building, with an attached building	TABULA	string	-	-
	is	**Terraced_Building**		-	small building, with two attached buildings	TABULA	string	-	-
	is	**Row_Building**		-	big building, with prevalent horizontal extension	TABULA	string	-	-
	is	**Tower_Building**		-	big building, with prevalent vertical extension	TABULA	string	-	-
	is	**Courtyard_Building**		-	big building having "L" or "U" shape	TABULA	string	-	-

Name/Acronym			Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
has	**Type_Of_Construction**		*type of building construction* [new]	type of building construction	-	string	-	**-**
	is	**Masonry**	-		SAP	string	-	-
	is	**…**						-
	is	**…**						-
has	**Conservation_State**		*conservation state*	conservation state of the building	-	string	-	**-**
	is	**New_Building**	-	building to be designed	-	string	-	-
	is	**Existing_Building**	-	existing building	-	string	-	-
	is	**Refurbished_Building**	-	building to be refurbished	-	string	-	-
has	**Building_Use**		*building use*	use of the building	-	string	-	**"b_use"**
has	**Building_Geometry**		-	geometry of the building	-	-	-	-
	has	**Building_Floor_Area**	*building floor area* [new]	sum of the areas of the building storeys	-	real	m^2	-
		is **Building_Gross_Floor_Area**	*building gross floor area* [new]	sum of the areas of the building storeys measured from the exterior faces of the exterior walls or from the centerline of walls separating buildings	-	real	m^2	-
		is **Building_Net_Floor_Area**	*building net floor area* [new]	sum of the areas of the building storeys measured from wall to wall inside the rooms of the building	-	real	m^2	-
	has	**Building_Volume**	*building volume* [new]	volume of the building	-	real	m^3	-
		is **Building_Gross_Volume**	*building gross volume* [new]	volume of the building measured from the exterior faces of the exterior walls and from the exterior face of the roof to the exterior face of the lower floor of the building	-	real	m^3	-
		is **Building_Net_Volume**	*building net volume* [new]	volume of the building measured from wall to wall inside the rooms and floor to ceiling inside the rooms of the building	-	real	m^3	-
	has	**Building_Perimeter**	*building perimeter* [new]	perimeter of the building measured from the exterior walls or from the centerline of walls separating buildings	-	real	m	-
	has	**Building_Height**	*building height*	height of the building measured from the exterior face of the roof to the exterior face of the lower floor of the building	-	real	m	-
	has	**Main_Orientation**	*buiding orientation*	the direction the main axis of the building	-	string	-	-
		is **North-South**	-	north-south direction	-	string	-	-
		is **East-West**	-	east-west direction	-	string	-	-
		is **North/West-South/East**	-	north/west-south/east direction	-	string	-	-
		is **North/East-South/West**	-	north/east-south/west direction	-	string	-	-

Name/Acronym	Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
has **Number_Of_Sides_Sheltered**	*number of sides sheltered* [new]	the number of sides of the building that are protected from the effects by wind, by stuff like trees, or other buildings, etc.	SAP	integer	-	-
has **Number_Of_Complete_Storeys**	*number of complete storeys*	number of floors/storeys of the building	TABULA*	integer	-	-
has **Basement**	*basement* [new]	usable part of a building that is situated partly or entirely below ground level	EN ISO 13370	string	-	-
has **Basement_Area**	*basement area* [new]	area of the basement	-	real	m^2	-
has **Basement_Height**	*basement height* [new]	height of the basement	-	real	m	-
has **Ground_Floor**	*ground floor* [new]	usable part of a building that is situated on ground level	-	string	-	-
has **Ground_Floor_Area**	*ground floor area* [new]	area of the ground floor	-	real	m^2	-
has **Ground_Floor_Height**	*ground floor height* [new]	height of the ground floor	-	real	m	-
has **Upper_Floor**	*upper floor* [new]	each floor/storey of the building that is situated above ground floor	-	string	-	-
has **Level**	*level of the upper floor* [new]	level of the upper floor (e.g. first floor, second floor, etc.)	-	integer	-	-
has **Upper_Floor_Area**	*upper floor area* [new]	area of the upper floor (e.g. area of the first floor, area of the second floor, etc.)	-	real	m^2	-
has **Upper_Floor_Height**	*upper floor height* [new]	height of the upper floor (e.g. height of the first floor, height of the second floor, etc.)	-	real	m	-
has **Number_Of_Apartments**	*number of apartments*	number of apartments of the building	TABULA	integer	-	-
has **Number_Of_Rooms**	*number of rooms* [new]	number of rooms in apartment	-	integer	-	-
has **Overall_Window_Surface**	*overall window surface* [new]	overall amount of windows	SAP	string	-	-
has **Overall_Window_Type**	-	type of the overall amount of windows	SAP	string	-	-
is **Double_Overall_Window**	-	overall amount of windows with double glass panel	-	string	-	-
is **Double_Post_2002_Overall_Window**	-		SAP	string	-	-
is **Double_Pre_2002_Overall_Window**	-		SAP	string	-	-
is **...**						-
has **Overall_Window_Area_Type**	-	approximate measure of the overall amount of windows vs some hypothetical average	SAP	string	-	-
is **Typical_Window_Area**	-		SAP	string	-	-
is **More_Than_Average_Window_Area**	-		SAP	string	-	-
is **Less_Than_Average_Window_Area**	-		SAP	string	-	-
has **Percentage_Of_Window/Door_Draught_Stripped**	*window percentage draught proofing*		SAP	real	%	-

Name/Acronym				Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
	has	3D_Location		*building coordinates*	-	-	real	-	-
		has	X-Coordinate	-	-	-	real	-	-
		has	Y-Coordinate	-	-	-	real	-	-
		has	Z-Coordinate	-	-	-	real	-	-
has	Space			-	enclosed space within a building	ANSI/ASHRAE 90.1	string	-	-
	is	Conditioned_Space		-	heated and/or cooled space	EN 15603 EN ISO 13790 ANSI/ASHRAE 90.1	string	-	-
		has	CS_Geometry	-	geometry of the conditioned space of the building	-	-	-	"cs_geometry"
		has	CS_Envelope	-	the exterior plus semi-exterior portions of a building (separing conditioned space from external environment or from unconditioned space)	ANSI/ASHRAE 90.1*	-	-	"cs_envelope"
		has	CS_Internal_Partitions	*internal partitions*	portions of a building within the conditioned space	-	-	-	"cs_internal_partitions"
		has	CS_Occupancy	-	characteristics of the conditioned space occupancy	-	-	-	"cs_occupancy"
		has	CS_Indoor_Air_Temperature	*indoor air temperature* [new]	arithmetic average of the air temperature and the mean radiant temperature at the centre of a zone or conditioned space	EN ISO 13790*	-	-	"cs_indoor_air_temperature"
		has	CS_Ventilation	-	characteristics of the ventilation of the conditioned space	-	-	-	"cs_ventilation"
		has	CS_Internal_Heat_Gains	*internal heat gains*	heat provided within the building by occupants (sensible metabolic heat) and by appliances such as domestic appliances, office equipment, etc., other than energy intentionally provided for heating, cooling or hot water preparation	EN ISO 13790	-	-	"cs_internal_heat_gains"
		has	Energy_Quantities_Related_To_Conditioned_Space	-	energy referred to building conditioned space	-	-	-	"energy_quantities"
	is	Unconditioned_Space		-	enclosed space within a building that is not a conditioned space or a semi-conditioned space; room or enclosure that is not part of a conditioned space	ANSI/ASHRAE 90.1 EN ISO 13790	string	-	-
		has	UCS_Geometry	-	geometry of the unconditioned space of the building	-	-	-	-
		has	UCS_Envelope	-	the exterior plus semi-exterior portions of a building (separing unconditioned space from external environment or from another unconditioned space)	ANSI/ASHRAE 90.1*	-	-	-
has	Technical_Building_System			-	technical equipment for heating, cooling, ventilation, domestic hot water, lighting and electricity production, composed of different subsystems	EN 15603 EN 15316-1	-	-	"building_system"
has	Energy_Consumption_And_Energy_Saving_Related_To_Building_Services			-	energy referred to building services	-	-	-	"energy_quantities"
has	Energy_Indicator			-	indicator of building energy performance	-	-	-	"energy_quantities"

Table A4. Standard Table *referred to the Excel sheet named "b_use"*

Name/Acronym			Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
Building_Use			*building use*	use of the building	-	string	-	-
is	**Residential**		*single-family houses of different types , apartment blocks*	residential: not specified or mixed residential utilisation	TABULA	string	-	-
	is	**Single-Family_House**	-	detached, or semi-detached, or terraced single family house	EPBD recast TABULA	string	-	-
	is	**Apartment_Block**	-	multi-family building	EPBD recast TABULA	string	-	-
is	**Office**		*offices*	office (general)	EPBD recast DATAMINE	string	-	-
	is	**Computer_Centre**	-	computer centre	DATAMINE	string	-	-
	is	**Stand-By_Duty**	-	on-call service, stand-by duty (police, fire brigade, technical services, call centres ...)	DATAMINE	string	-	-
is	**Educational**		*educational buildings*	education / school: not specified or mixed	EPBD recast DATAMINE	string	-	-
	is	**School**	-	ordinary school, special school	DATAMINE	string	-	-
	is	**School_Vocational**	-	vocational school	DATAMINE	string	-	-
	is	**Kindergarten**	-	kindergarten, nursery school	DATAMINE	string	-	-
	is	**Higher_Education**	-	higher education: not specified or mixed	DATAMINE	string	-	-
	is	**Lecture**	-	lecture hall	DATAMINE	string	-	-
	is	**Laboratory**	-	laboratory	DATAMINE	string	-	-
	is	**Library**	-	library	DATAMINE	string	-	-
is	**Hospital**		*hospitals*	hospital / health care: not specified or standard hospital utilisation	EPBD recast DATAMINE	string	-	-
	is	**Surgery**	-	operating room, emergency surgery etc.	DATAMINE	string	-	-
	is	**Nursing**	-	sick-nursing, long-term care	DATAMINE	string	-	-
is	**Trade_Services**		*wholesale and retail trade services buildings*	trade: not specified or mixed	EPBD recast DATAMINE	string	-	-
	is	**Retail_Trade**	-	retail trade, shop	EPBD recast DATAMINE	string	-	-
	is	**Wholesale**	-	storage depot, wholesale	EPBD recast DATAMINE	string	-	-
	is	**Production**	-	production, workshop, maintenance	DATAMINE	string	-	-
	is	**Agriculture**	-	agriculture, animal husbandry, plant breeding	DATAMINE	string	-	-
	is	**Hotel**	-	hotel, hostel	DATAMINE	string	-	-
is	**Hotel_Restaurant**		*hotels and restaurants*	hotel and restaurant: not specified mixed utilisation	EPBD recast DATAMINE	string	-	-
	is	**Hotel**	-	hotel, hostel	DATAMINE	string	-	-
	is	**Restaurant**	-	restaurant	DATAMINE	string	-	-

Name/Acronym			Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
is	**Sports_Facilities**		*sport facilities*	sports: not specified or mixed sports utilisation	EPBD recast DATAMINE	string	-	-
	is	**Sports_Hall**	-	sports hall, fitness centre etc.	DATAMINE	string	-	-
	is	**Swimming_Pool**	-	indoor swimming pool	DATAMINE	string	-	-
is	**Other_Uses**		*other types of energy-consuming buildings*	other utilisations: not specified or mixed	DATAMINE	string	-	-
	is	**Assembly**	-	assembly hall, arrival hall, church, concert hall, museums	DATAMINE	string	-	-
	is	**Day_Care**	-	day care (youth centres, senior centres, ...)	DATAMINE	string	-	-
	is	**Garage**	-	garage, underground car park	DATAMINE	string	-	-

Table A5. Standard Table *referred to the Excel sheet named "cs_geometry"*

Name/Acronym				Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
CS_Geometry				-	geometry of the conditioned space of the building	-	-	-	-
has	**Conditioned_Floor_Area**			*building conditioned floor area* [new]	floor area of conditioned spaces excluding non-habitable cellars or non-habitable parts of a space, including the floor area on all storeys if more than one	EN 15217 EN ISO 13790	real	m^2	-
	is	**Conditioned_Gross_Floor_Area**		*building conditioned gross floor area*	conditioned area - external dimension (i.e. length measured on the exterior of a building)	EN 15217	real	m^2	-
	is	**Conditioned_Net_Floor_Area**		*building conditioned net floor area*	conditioned area - internal dimension (i.e. length measured from wall to wall inside a room of a building)	EN 15217	real	m^2	-
has	**Conditioned_Volume**			*building conditioned volume* [new]	volume inside the building envelope of the conditioned spaces	NREL/TP-550-38600	real	m^3	-
	is	**Conditioned_Gross_Volume**		*building conditioned gross volume*	conditioned volume - external dimension (i.e. dimension measured on the exterior of a building)	EN ISO 13789	real	m^3	-
	is	**Conditioned_Net_Volume**		*building conditioned net volume*	conditioned volume - internal dimension (i.e. dimension measured from wall to wall and floor to ceiling inside a room of a building)	EN ISO 13789	real	m^3	-
has	**Thermal_Envelope_Area**			*thermal envelope area*	total of the area of all elements of a building that enclose conditioned spaces through which thermal energy is transferred to or from the external environment or to or from unconditioned spaces	EN 15217	real	m^2	-
	is	**Thermal_Envelope_Area-External_Dimension**		*thermal envelope area - external dimension*	thermal envelope area - dimension measured on the exterior of a building	EN ISO 13789	real	m^2	-
		has	**Exposed_Wall_Area_Gross**	-	thermal envelope area, only walls - dimension measured on the exterior of a building	SAP	real	m^2	-
	is	**Thermal_Envelope_Area-Internal_Dimension**		*thermal envelope area - internal dimension*	thermal envelope area - dimension measured from wall to wall and floor to ceiling inside a room of a building	EN ISO 13789	real	m^2	-
	is	**Thermal_Envelope_Area-Overall_Internal_Dimension**		*thermal envelope area - overall internal dimension*	thermal envelope area - dimension measured on the interior of a building, ignoring internal partitions	EN ISO 13789	real	m^2	-

Name/Acronym		Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
has	**Shape_Factor**	*shape factor*	ratio between the thermal envelope area and the conditioned floor area	EN 15217	real	-	-
has	**Compactness_Ratio**	*compactness ratio*	ratio between the thermal envelope area and the conditioned volume	EN 15217	real	m^{-1}	-

Table A6. Standard Table *referred to the Excel sheet named "cs_envelope"*

Name/Acronym					Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
CS_Envelope					-	the exterior plus semi-exterior portions of a building (separing conditioned space from external environment or from unconditioned space)	ANSI/ASHRAE 90.1*	-	-	**-**
has	**Vertical_Enclosure**				-	portion of the building envelope, including opaque surface and vertical fenestration, that is vertical or tilted at an angle of 60 degrees from horizontal or greater	ANSI/ASHRAE 90.1*	string	-	-
	has	**Wall**			*wall* [new]	opaque surface of the vertical enclosure	ANSI/ASHRAE 90.1*	string	-	**-**
		has	**Wall_Type**		*type of wall*	type of wall	-	string	-	-
			is	**Mass_Wall**	-	a wall with an heat capacity exceeding 143 kJ/m^2K, provided that the wall has a material unit weight not greater than 1920 kg/m^3	ANSI/ASHRAE 90.1	string	-	-
			is	**Metal_Building_Wall**	-	a wall whose structure consists of metal spanning members supported by steel structural members	ANSI/ASHRAE 90.1	string	-	-
			is	**Steel-framed_Wall**	-	a wall with a cavity (insulated or otherwise) whose exterior surfaces are separated by steel framing members (e.g. curtain wall systems)	ANSI/ASHRAE 90.1	string	-	-
			is	**Wood-framed_Wall**	-	wood stud wall	ANSI/ASHRAE 90.1	string	-	-
			is	**Cavity_Wall**	-		SAP	string	-	**-**
			is	**Solid_Brick_As_Built_Wall**	-		SAP	string	-	**-**
			is	**…**	-					**-**
			is	**…**	-					**-**
		has	**Orientation**		*orientation* [new]	the direction an envelope element faces, i.e. the direction of a vector perpendicular to and pointing away from the surface outside of the element	ANSI/ASHRAE 90.1	string	-	**"SPACE"**
		has	**Wall_Adjacent_Space**		*wall adjoining space*	space adjacent to the wall	-	string	-	-
			is	**External_Environment**	-	external unenclosed space	-	string	-	-
			is	**Unconditioned_Space**	-	enclosed space within a building that is not a conditioned space or a semi-conditioned space; room or enclosure that is not part of a conditioned space	ANSI/ASHRAE 90.1 EN ISO 13790	string	-	-
			is	**Adjacent_Building**	-	a building adjacent to the wall	-	string	-	-
			is	**Ground**	*type of ground* [new]	ground	-	string	-	-
		has	**Wall_Area**		*wall area*	the area of the wall measured on the exterior face from the top of the floor to the bottom of the roof	ANSI/ASHRAE 90.1	real	m^2	-
		has	**Wall_Dimension**		*wall dimensions*	size of the wall, defined through two dimensions (length and height)	-	-	-	-
			has	**Wall_Length**	*wall length* [new]	length of the wall	-	real	m	-
			has	**Wall_Height**	*wall height* [new]	height of the wall	-	real	m	-
		has	**Wall_Thickness**		*wall thickness*	thickness of the wall	-	real	m	-

Name/Acronym							Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
		has	**Wall_Insulation**				*wall insulation*	insulation of the wall	-	string	-	-
			has	**Wall_Insulation_Type**			*type of wall insulation* [new]	type of insulation of the wall	-	string	-	-
					is	**Cavity_As_Built_Wall_Insulation**	-		SAP	string	-	-
					is	**Filled_Cavity_Wall_Insulation**	-		SAP	string	-	-
					is	**Solid_Brick_As_Built_Wall_Insulation**	-		SAP	string	-	-
					is	**…**	-					-
					is	**…**	-					-
			has	**Wall_Insulation_Thickness**			*wall insulation thickness*	thickness of the insulation of the wall	-	real	m	-
		has	**Wall_U-value**				*wall U-value*	thermal transmittance of the wall: heat flow density through the wall divided by the difference in environmental temperatures on either side of the wall in steady-state condition	-	real	W/(m^{2}K)	-
		has	**Wall_α-value**				*wall α-value*	solar absorption factor of the surface of the wall: fraction of incident solar irradiance that is absorbed by the surface of the wall	-	real	-	-
		has	**Wall_Fsh,ob-value**				*wall Fsh,ob-value* [new]	shading reduction factor of the wall for external obstacles	EN ISO 13790	real	-	-
	has	**Window**					*window [new]*	or vertical fenestration, fenestration surface having a slope of more than 60 degrees from the horizontal plane	ANSI/ASHRAE 90.1	string	-	-
		has	**Window_Type**				*type of window*	type of window	-	string	-	-
			is	**Double_Window**			-	window with double glass panel	-	string	-	-
				is	**Double_Post_2002_Window**		-		SAP	string	-	-
				is	**Double_Pre_2002_Window**		-		SAP	string	-	-
			is	**…**			-					-
			is	**…**			-					-
		has	**Orientation**				*orientation* [new]	the direction an envelope element faces, i.e. the direction of a vector perpendicular to and pointing away from the surface outside of the element	ANSI/ASHRAE 90.1	string	-	**"SPACE"**
		has	**Window_Adjacent_Space**				*window adjoining space*	space adjacent to the window	-	string	-	-
			is	**External_Environment**			-	external unenclosed space	-	string	-	-
			is	**Unconditioned_Space**			-	enclosed space within a building that is not a conditioned space or a semi-conditioned space; room or enclosure that is not part of a conditioned space	ANSI/ASHRAE 90.1 EN ISO 13790	string	-	-
		has	**Window_Area**				*window area*	total area of the window measured using the rough opening and including the glass, sash, and frame	ANSI/ASHRAE 90.1*	real	m^2	-
		has	**Window_Dimension**				*window dimensions*	size of the window, defined through two dimensions (length and height)	-	-	-	-
			has	**Window_Length**			*window length* [new]	length of the window	-	real	m	-
			has	**Window_Height**			*window height* [new]	height of the window	-	real	m	-
			has	**Window_Setback**			*window setback* [new]	setback of the window	-	real	m	-
		has	**Window_U-value**				*window U-value*	thermal transmittance of the window: heat flow density through the window divided by the difference in environmental temperatures on either side of the window in steady-state condition	-	real	W/(m^{2}K)	-
		has	**Window_Glass**				*window glass* [new]	the glazing panel of a window	EN ISO 10077-1	string	-	-
			has	**Window_Glass_Type**			*type of window glass*	type of window glass	-	string	-	-
					is	**Single_Window_Glass**	-		SAP	string	-	-
					is	**Double_Post_2002_Window_Glass**	-		SAP	string	-	-
					is	**…**	-					-
			has	**Window_Glass_Area**			*window glass area*	area of the glazing panel of a window	EN ISO 10077-1	real	m^2	-
			has	**Window_Glass_U-value**			*window glass U-value*	thermal transmittance of the window glass: heat flow density through the window glass divided by the difference in environmental temperatures on either side of the window glass in steady-state condition	-	real	W/(m^{2}K)	-

Name/Acronym	Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
has **Window_Glass_g-value**	*window glass g-value*	total solar energy transmittance coefficient of the window glass: the ratio of the solar heat gain entering the space through the window glass area to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted, or convected into the conditioned space	ANSI/ASHRAE 90.1*	real	-	-
has **Window_Glass_Plus_Shading_g-value**	*window glass plus shading g-value* [new]	total solar energy transmittance coefficient of the window glass plus solar shading, when the solar shading is in use	EN ISO 13790	real	-	-
has **Window_Frame**	*window frame* [new]	the frame of a window	EN ISO 10077-1	string	-	-
has **Window_Frame_Type**	*type of window frame* [new]	type of window frame	-	string	-	-
has **Window_Frame_Area**	*window frame area* [new]	the larger of the two projected areas (internal projected frame area and external projected frame area) seen from both sides. The internal projected frame area is the area of the projection of the internal frame, including sashes if present, on a plane parallel to the glazing panel. The external projected frame area is the area of the projection of the external frame, including sashes if present, on a plane parallel to the glazing panel	EN ISO 10077-1	real	m^2	-
has **Window_Frame_U-value**	*window frame U-value* [new]	thermal transmittance of the window frame: heat flow density through the window frame divided by the difference in environmental temperatures on either side of the window frame in steady-state condition	-	real	$W/(m^2K)$	-
has **Window_Overhang**	*window overhang* [new]	overhang on the window	-	string	-	-
has **Window_Overhang_Geometry**	*window overhang geometry [new]*	geometry referred to the overhang of the window	-	-	-	-
has **Window_Overhang_Distance_From_Upper_Edge**	-	distance of the overhang from the upper edge of the window	-	real	m	-
has **Window_Overhang_Distance_From_Right_Edge**	-	distance of the overhang from the right edge of the window	-	real	m	-
has **Window_Overhang_Distance_From_Left_Edge**	-	distance of the overhang from the left edge of the window	-	real	m	-
has **Window_Overhang_Width_Upper**	-	width of the upper part of the overhang	-	real	m	-
has **Window_Overhang_Width_Right**	-	width of the right part of the overhang	-	real	m	-
has **Window_Overhang_Width_Left**	-	width of the left part of the overhang	-	real	m	-
has **Window_Overshading_Type**	*window degree of overshading* [new]		SAP	string	-	-
is **Window_Average_Overshading**	-		SAP	string	-	-
is **Window_Heavy_Overshading**	-		SAP	string	-	-
is **…**						
has **Window_Fsh,ob-value**	*window Fsh,ob-value* [new]	shading reduction factor of the window for external obstacles	EN ISO 13790	real	-	-
has **Door**	*door* [new]	operable opening area (which is not window) in the vertical enclosure, including swinging and roll-up door, fire door, and access hatch. Door that is more than one-half glass is considered window	ANSI/ASHRAE 90.1*	string	-	-
has **Door_Type**	*type of door*	type of door	-	string	-	-
is **Nonswinging_Door**	-	roll-up, sliding, and all other doors that are not swinging doors	ANSI/ASHRAE 90.1	string	-	-
is **Swinging_Door**	-	all operable opaque panels with hinges on one side and opaque revolving doors	ANSI/ASHRAE 90.1	string	-	-
is **…**						
has **Orientation**	*orientation* [new]	the direction an envelope element faces, i.e. the direction of a vector perpendicular to and pointing away from the surface outside of the element	ANSI/ASHRAE 90.1	string	-	**"SPACE"**

Name/Acronym					Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
		has	**Door_Adjacent_Space**		*door adjoining space*	space adjacent to the door	-	string	-	-
			is	**External_Environment**	-	external unenclosed space	-	string	-	-
			is	**Unconditioned_Space**	-	enclosed space within a building that is not a conditioned space or a semi-conditioned space; room or enclosure that is not part of a conditioned space	ANSI/ASHRAE 90.1 EN ISO 13790	string	-	-
		has	**Door_Area**		*door area*	total area of the door measured using the rough opening and including the door slab and the frame	ANSI/ASHRAE 90.1	real	m^2	-
		has	**Door_Dimension**		*door dimensions*	size of the door, defined through two dimensions (length and height)	-	-	-	-
			has	**Door_Length**	*door length* [new]	length of the door	-	real	m	-
			has	**Door_Height**	*door height* [new]	height of the door	-	real	m	-
		has	**Door_Thickness**		*door thickness*	thickness of the door	-	real	m	-
		has	**Door_Insulation**		*door insulation*	insulation of the door	-	string	-	-
			has	**Door_Insulation_Type**	*type of door insulation* [new]	type of insulation of the door	-	string	-	-
			has	**Door_Insulation_Thickness**	*door insulation thickness*	thickness of the insulation of the door	-	real	m	-
		has	**Door_U-value**		*door U-value*	thermal transmittance of the door: heat flow density through the door divided by the difference in environmental temperatures on either side of the door in steady-state condition	-	real	$W/(m^2K)$	-
		has	**Door_α-value**		*door α-value*	solar absorption factor of the surface of the door: fraction of incident solar irradiance that is absorbed by the surface of the door	-	real	-	-
		has	**Door_Fsh,ob-value**		*door Fsh,ob-value* [new]	shading reduction factor of the door for external obstacles	EN ISO 13790	real	-	-
has	**Horizontal_Superior_Enclosure**				-	upper portion of the building envelope, including opaque surface and fenestration, that is horizontal or titled at an angle of less than 60 degrees from horizontal (separing conditioned space by external environment)	ANSI/ASHRAE 90.1*	string	-	-
	has	**Roof**			*roof* [new]	opaque surface of the horizontal superior enclosure	ANSI/ASHRAE 90.1*	string	-	-
		has	**Roof_Type**		*type of roof*	type of roof	-	string	-	-
			is	**Pitched_Slates_Or_Tiles_Roof**	-		SAP	string	-	-
			is	**…**	-					-
			is	**…**	-					-
		has	**Orientation**		*orientation* [new]	the direction an envelope element faces, i.e. the direction of a vector perpendicular to and pointing away from the surface outside of the element	ANSI/ASHRAE 90.1	string	-	**"SPACE"**
		has	**Roof_Tilt**		*roof tilt* [new]	angle between the plane cointaining the surface of the roof and the horizontal plane	-	real	°	-
		has	**Roof_Area**		*roof area*	the area of the roof measured from the exterior faces of walls of from the centerline of party walls	ANSI/ASHRAE 90.1	real	m^2	-
		has	**Roof_Thickness**		*roof thickness*	thickness of the roof	-	real	m	-
		has	**Roof_Insulation**		*roof insulation*	insulation of the roof	-	string	-	-
			has	**Roof_Insulation_Type**	*type of roof insulation* [new]	type of insulation of the roof	-	string	-	-
			has	**Roof_Insulation_Thickness**	*roof insulation thickness*	thickness of the insulation of the roof	-	real	m	-
		has	**Roof_U-value**		*roof U-value*	thermal transmittance of the roof: heat flow density through the roof divided by the difference in environmental temperatures on either side of the roof in steady-state condition	-	real	$W/(m^2K)$	-
		has	**Roof_α-value**		*roof α-value*	solar absorption factor of the surface of the roof: fraction of incident solar irradiance that is absorbed by the surface of the roof	-	real	-	-
		has	**Roof_Fsh,ob-value**		*roof Fsh,ob-value* [new]	shading reduction factor of the roof for external obstacles	EN ISO 13790	real	-	-

Name/Acronym	Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
has **Skylight**	*skylight* [new]	fenestration surface having a slope of less than 60 degrees from the horizontal plane	ANSI/ASHRAE 90.1	string	-	-
has **Skylight_Type**	*type of skylight*	type of skylight	-	string	-	-
is **Double_Skylight**	-	skylight with double glass panel	-	string	-	-
is **Double_Post_2002_Skylight**	-		SAP	string	-	-
is **Double_Pre_2002_Skylight**	-		SAP	string	-	-
has **Orientation**	*orientation* [new]	the direction an envelope element faces, i.e. the direction of a vector perpendicular to and pointing away from the surface outside of the element	ANSI/ASHRAE 90.1	string	-	**"SPACE"**
has **Skylight_Tilt**	*skylighy tilt* [new]	angle between the plane cointaining the surface of the skylight and the horizontal plane	-	real	°	-
has **Skylight_Area**	*skylight area*	total area of the skylight measured using the rough opening and including the glass, sash, and frame	ANSI/ASHRAE 90.1*	real	m^2	-
has **Skylight_Dimension**	*skylight dimensions*	size of the skylight, defined through two dimensions (length and width)	-	-	-	-
has **Skylight_Length**	*skylight length* [new]	length of the skylight	-	real	m	-
has **Skylight_Width**	*skylight width* [new]	width of the skylight	-	real	m	-
has **Skylight_U-value**	*skylight U-value*	thermal transmittance of the skylight: heat flow density through the skylight divided by the difference in environmental temperatures on either side of the skylight in steady-state condition	-	real	$W/(m^2K)$	-
has **Skylight_Glass**	*skylight glass* [new]	the glazing panel of a skylight	EN ISO 10077-1*	string	-	-
has **Skylight_Glass_Type**	*type of skylight glass*	type of skylight glass	-	string	-	-
is **Single_Skylight_Glass**	-		SAP	string	-	-
is **Double_Post_2002_Skylight_Glass**	-		SAP	string	-	-
is **...**	-					-
has **Skylight_Glass_Area**	*skylight glass area*	area of the glazing panel of a skylight	EN ISO 10077-1*	real	m^2	-
has **Skylight_Glass_U-value**	*skylight glass U-value*	thermal transmittance of the skylight glass: heat flow density through the skylight glass divided by the difference in environmental temperatures on either side of the skylight glass in steady-state condition	-	real	$W/(m^2K)$	-
has **Skylight_Glass_g-value**	*skylight glass g-value*	total solar energy transmittance coefficient of the skylight glass: the ratio of the solar heat gain entering the space through the skylight glass area to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted, or convected into the conditioned space	ANSI/ASHRAE 90.1*	real	-	-
has **Skylight_Glass_Plus_Shading_g-value**	*skylight glass plus shading g-value* [new]	total solar energy transmittance coefficient of the skylight glass plus solar shading, when the solar shading is in use	EN ISO 13790*	real	-	-
has **Skylight_Frame**	*type of skylight frame* [new]	the frame of a skylight	EN ISO 10077-1*	string	-	-
has **Skylight_Frame_Area**	*skylight frame area* [new]	the larger of the two projected areas (internal projected frame area and external projected frame area) seen from both sides. The internal projected frame area is the area of the projection of the internal frame, including sashes if present, on a plane parallel to the glazing panel. The external projected frame area is the area of the projection of the external frame, including sashes if present, on a plane parallel to the glazing panel	EN ISO 10077-1	real	m^2	-
has **Skylight_Frame_U-value**	*skylight frame U-value* [new]	thermal transmittance of the skylight frame: heat flow density through the skylight frame divided by the difference in environmental temperatures on either side of the skylight frame in steady-state condition	-	real	$W/(m^2K)$	-

Name/Acronym				Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
		has	**Skylight_Overshading_Type**	*skylight degree of overshading* [new]		SAP	string	-	-
			is **Skylight_Average_Overshading**	-		SAP	string	-	-
			is **Skylight_Heavy_Overshading**	-		SAP	string	-	-
			is **…**						
		has	**Skylight_Fsh,ob-value**	*skylight Fsh,ob-value* [new]	shading reduction factor of the skylight for external obstacles	EN ISO 13790*	real	-	-
has	**Ceiling**			*ceiling* [new]	upper portion of the building envelope, including opaque surface and fenestration, that is horizontal or titled at an angle of less than 60° from horizontal (separating conditioned space by unconditioned space)	ANSI/ASHRAE 90.1*	string	-	-
	has	**Ceiling_Type**		*type of ceiling*	type of ceiling	-	string	-	-
	has	**Ceiling_Adjacent_Space**		*ceiling adjoining space*	space adjacent to the ceiling	-	string	-	-
		is	**Unconditioned_Space**	-	enclosed space within a building that is not a conditioned space or a semi-conditioned space; room or enclosure that is not part of a conditioned space	ANSI/ASHRAE 90.1 EN ISO 13790	string	-	-
	has	**Ceiling_Area**		*ceiling area*	the area of the ceiling measured from the exterior faces of walls of from the centerline of party walls	ANSI/ASHRAE 90.1*	real	m^2	-
	has	**Ceiling_Dimension**		*ceiling dimensions*	size of the ceiling, defined through two dimensions (length and width)	-	-	-	-
		has	**Ceiling_Length**	*ceiling length* [new]	length of the ceiling	-	real	m	-
		has	**Ceiling_Width**	*ceiling width* [new]	width of the ceiling	-	real	m	-
	has	**Ceiling_Thickness**		*ceiling thickness*	thickness of the ceiling	-	real	m	-
	has	**Ceiling_Insulation**		*ceiling insulation*	insulation of the ceiling	-	string	-	-
		has	**Ceiling_Insulation_Type**	*type of ceiling insulation* [new]	type of insulation of the ceiling	-	string	-	-
		has	**Ceiling_Insulation_Thickness**	*ceiling insulation thickness*	thickness of the insulation of the ceiling	-	real	m	-
	has	**Ceiling_U-value**		*ceiling U-value*	thermal transmittance of the ceiling: heat flow density through the ceiling divided by the difference in environmental temperatures on either side of the ceiling in steady-state condition	-	real	$W/(m^2K)$	-
has	**Bottom_Floor**			*bottom floor* [new]	lower portion of the building envelope, including opaque surface, that is horizontal or titled at an angle of less than 60° from horizontal	ANSI/ASHRAE 90.1*	string	-	-
	has	**Bottom_Floor_Type**		*type of bottom floor*	type of bottom floor	-	string	-	-
		is	**Mass_Floor**	-	a floor with an heat capacity that exceeds 143 kJ/m^2K, provided that the floor has a material unit mass not greater than 1920 kg/m^3	ANSI/ASHRAE 90.1	string	-	-
		is	**Steel-joist_Floor**	-	a floor that has steel joist members supported by structural members	ANSI/ASHRAE 90.1	string	-	-
		is	**Wood-framed_Floor**	-	wood joist floor	ANSI/ASHRAE 90.1	string	-	-
		is	**Sealed_Wooden_Floor**	-		SAP	string	-	-
		is	**Unsealed_Wooden_Floor**	-		SAP	string	-	-
		is	**Other_Floor**	-		SAP	string	-	-

Name/Acronym			Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
has	**Bottom_Floor_Adjacent_Space**		*bottom floor adjoining space*	space adjacent to the bottom floor	-	string	-	-
	is	**External_Environment**	-	external unenclosed space	-	string	-	-
	is	**Unconditioned_Space**	-	enclosed space within a building that is not a conditioned space or a semi-conditioned space; room or enclosure that is not part of a conditioned space	ANSI/ASHRAE 90.1 EN ISO 13790	string	-	-
	is	**Ground**	*type of ground* [new]	ground	-	string	-	-
has	**Bottom_Floor_Area**		*bottom floor area*	the area of the bottom floor measured from the exterior faces of walls of from the centerline of party walls	ANSI/ASHRAE 90.1*	real	m^2	-
has	**Bottom_Floor_Dimension**		*bottom floor dimensions*	size of the bottom floor, defined through two dimensions (length and width)	-	-	-	-
	has	**Bottom_Floor_Lenght**	*bottom floor length* [new]	length of the bottom floor	-	real	m	-
	has	**Bottom_Floor_Width**	*bottom floor width* [new]	width of the bottom floor	-	real	m	-
has	**Bottom_Floor_Thickness**		*bottom floor thickness*	thickness of the bottom floor	-	real	m	-
has	**Bottom_Floor_Insulation**		*bottom floor insulation*	insulation of the bottom floor	-	string	-	-
	has	**Bottom_Floor_Insulation_Type**	*type of bottom floor insulation* [new]	type of insulation of the bottom floor	-	string	-	-
	has	**Bottom_Floor_Insulation_Thickness**	*bottom floor insulation thickness*	thickness of the insulation of the bottom floor	-	real	m	-
has	**Bottom_Floor_U-value**		*bottom floor U-value*	thermal transmittance of the bottom floor: heat flow density through the bottom floor divided by the difference in environmental temperatures on either side of the bottom floor in steady-state condition	-	real	$W/(m^2K)$	-

Table A7. Standard Table *referred to the Excel sheet named "cs_internal_partitions"*

Name/Acronym			Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
CS_Internal_Partitions			*internal partitions*	portions of a building within the conditioned space	-	-	-	-
has	**Internal_Wall**		*internal wall* [new]	wall within the conditioned space	-	string	-	-
	has	**Internal_Wall_Type**	*type of internal wall* [new]	type of internal wall	-	string	-	-
	has	**Internal_Wall_Area**	*internal wall area* [new]	area of the internal wall	-	real	m^2	-
	has	**Internal_Wall_Areal_Heat_Capacity**	*internal wall areal heat capacity* [new]	modulus of the net periodic thermal conductance divided by the angular frequency, referred to the area of the internal wall	EN ISO 13786	real	$J/(m^2K)$	-
has	**Intermediate_Floor**		*intermediate floor* [new]	floor within the conditioned space	-	string	-	-
	has	**Intermediate_Floor_Type**	*type of intermediate floor* [new]	type of intermediate floor	-	string	-	-
	has	**Intermediate_Floor_Area**	*intermediate floor area* [new]	area of the intermediate floor	-	real	m^2	-
	has	**Intermediate_Floor_Areal_Heat_Capacity**	*intermediate floor areal heat capacity* [new]	modulus of the net periodic thermal conductance divided by the angular frequency, referred to the area of the intermediate floor	EN ISO 13786	real	$J/(m^2K)$	-

Table A8. Standard Table *referred to the Excel sheet named "cs_occupancy"*

Name/Acronym				Corresponding Name in D3.1	Description	Reference	Type of data (descriptive / numeric)	Unit	Reference to other sheets
CS_Occupancy				-	characteristics of the conditioned space occupancy	-	-	-	-
has	**Crowding_Index**			*crowding index* [new]	number of occupants in the conditioned space referred to the conditioned net floor area	-	real	m^{-2}	-
has	**Occupation_Intensity**			-	-	-	-	-	-
	is	**Number_Of_Occupants**		*number of occupants* [new]	number of occupants in the conditioned space	-	real	-	-
	is	**Percentage_Of_Occupation**		*percentage of occupation* [new]	number of occupants in the conditioned space compared to a total number of occupants	-	real	-	-
	has	**Time_Aggregation_Type**		-	type of time aggregation for the determination of the value	-	string	-	**"TIME"**
	has	**Time_Aggregation_Period**		-	period to which the aggregation for the determination of the value refers	-	string	-	**"TIME"**
	has	**Period**		-	time to which the value refers	-	string	-	**"TIME"**
has	**Presence_Time**			-	-	-	-	-	-
	is	**Number_Of_Hours_Present**		*number of hours present* [new]	number of hours in which an element is (or is used) in the conditioned space	-	real	h	-
	is	**Fraction_Of_Time_Present**		*fraction of time present* [new]	fraction of time in which an element is in the conditioned space	-	real	-	-
	has	**Presence_Time_Element**		-	-	-	string	-	-
		is	**Occupants**	-	-	-	string	-	-
		is	**Electrical_Appliances**	-	-	-	string	-	-
	has	**Period**		-	time to which the value refers	-	string	-	**"TIME"**

Table A9. Standard Table *referred to the Excel sheet named "cs_indoor_air_temperature"*

Name/Acronym		Corresponding Name in D3.1	Description	Reference	Type of data (descriptive / numeric)	Unit	Reference to other sheets
CS_Indoor_Air_Temperature		*indoor air temperature [new]*	arithmetic average of the air temperature and the mean radiant temperature at the centre of a zone or conditioned space	EN ISO 13790*	-	-	-
is	**CS_Temperature_Heating_Mode**	*indoor air temperature (space heating)*	internal (minimum intended) temperature as fixed by the control system in normal heating mode	EN ISO 13790	real	°C	-
is	**CS_Temperature_Cooling_Mode**	*indoor air temperature (space cooling)*	internal (maximum intended) temperature as fixed by the control system in normal cooling mode	EN ISO 13790	real	°C	-
has	**Time_Aggregation_Type**	-	type of time aggregation for the determination of the value	-	string	-	**"TIME"**
has	**Time_Aggregation_Period**	-	period to which the aggregation for the determination of the value refers	-	string	-	**"TIME"**
has	**Period**	-	time to which the value refers	-	string	-	**"TIME"**

Table A10. Standard Table *referred to the Excel sheet named "cs_ventilation"*

Name/Acronym				Corresponding Name in D3.1	Description	Reference	Type of data (descriptive / numeric)	Unit	Reference to other sheets
CS_Ventilation				-	characteristics of the ventilation of the conditioned space	-	-	-	-
has	**Time_Aggregation_Type**			-	type of time aggregation for the determination of the value	-	string	-	**"TIME"**
has	**Time_Aggregation_Period**			-	period to which the aggregation for the determination of the value refers	-	string	-	**"TIME"**
has	**Period**			-	time to which the value refers	-	string	-	**"TIME"**
is	**CS_Natural_Ventilation**			-	the process of supplying or removing air by natural means to or from a conditioned space	ANSI/ASHRAE 90.1*	string	-	-
	has	**Natural_Ventilation_Parameter**		-	parameter for evaluating natural ventilation	-	-	-	-
		is	**NV_Air_Exchange_Rate**	*air exchange rate*	the ratio between the volumetric hourly airflow rate by natural ventilation and the volume of the conditioned space	-	real	$m^3/(h \cdot m^3)$	-
		is	**NV_Volumetric_Airflow_Rate**	*volumetric airflow rate*	volume of air by natural ventilation in unit of time	-	real	m^3/s	-
		is	**NV_Mass_Airflow_Rate**	*mass airflow rate*	mass of air by natural ventilation in unit of time	-	real	kg/s	-
	has	**Natural_Ventilation_Device**		-	device of natural ventilation	-	string	-	-
		is	**Global_Contribution**	-	contribution of all natural ventilation devices	-	string	-	-
		is	**Openings**	-	openings, such as windows, skylights, etc.	-	string	-	-
		is	**Chimneys**	-		SAP	string	-	-
		is	**Open_Flues**	-		SAP	string	-	-
		is	**Passive_Vents**	-		SAP	string	-	-
		is	**Flueless_Gas_Fires**	-		SAP	string	-	-
		is	**Draught_Lobby**	-		SAP	string	-	-
		is	**…**						-
	has	**Number_Of_Natural_Ventilation_Device**		-	number of natural ventilation devices of the same type	-	integer	-	-
is	**CS_Mechanical_Ventilation**			-	the process of supplying or removing air by mechanical means to or from a conditioned space	ANSI/ASHRAE 90.1*	string	-	-
	has	**Mechanical_Ventilation_Parameter**		-	parameter for evaluating mechanical ventilation	-	-	-	-
		is	**MV_Air_Exchange_Rate**	*air exchange rate*	the ratio between the volumetric hourly airflow rate by mechanical ventilation and the volume of the conditioned space	-	real	$m^3/(h \cdot m^3)$	-
		is	**MV_Volumetric_Airflow_Rate**	*volumetric airflow rate*	volume of air by mechanical ventilation in unit of time	-	real	m^3/s	-
		is	**MV_Mass_Airflow_Rate**	*mass airflow rate*	mass of air by mechanical ventilation in unit of time	-	real	kg/s	-
	has	**Mechanical_Ventilation_Device**		-	device of mechanical ventilation	-	string	-	-
		is	**Intermittent_Fans**	-		SAP	string	-	-
		is	**…**						-
	has	**Number_Of_Mechanical_Ventilation_Device**		-	number of mechanical ventilation devices of the same type	-	integer	-	-

Table A11. Standard Table *referred to the Excel sheet named "cs_internal_heat_gains"*

Name/Acronym		Corresponding Name in D3.1	Description	Reference	Type of data (descriptive / numeric)	Unit	Reference to other sheets
CS_Internal_Heat_Gains		*internal heat gains*	heat provided within the building by occupants (sensible metabolic heat) and by appliances such as domestic appliances, office equipment, etc., other than energy intentionally provided for heating, cooling or hot water preparation	EN ISO 13790	-	-	-
is	**CS_Internal_Heat_Gains_By_Occupants**	*internal heat gains by occupants*	heat provided within the building by occupants (sensible metabolic heat)	EN ISO 13790	real	W	-
is	**CS_Internal_Heat_Gains_By_Electrical_Appliances**	*internal heat gains by electrical appliances*	heat provided within the building by applicances such as domestic appliances, office equipment, etc., other than energy intentionally provided for heating, cooling or hot water preparation	EN ISO 13790	real	W	-
is	**…**						-
has	**Time_Aggregation_Type**	-	type of time aggregation for the determination of the value	-	string	-	**"TIME"**
has	**Time_Aggregation_Period**	-	period to which the aggregation for the determination of the value refers	-	string	-	**"TIME"**
has	**Period**	-	time to which the value refers	-	string	-	**"TIME"**

Table A12. Standard Table *referred to the Excel sheet named "building_system"*

Name/Acronym			Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
Technical_Building_System			-	technical equipment for heating, cooling, ventilation, domestic hot water, lighting and electricity production, composed of different subsystems	EN 15603 EN 15316-1	-	-	-
is	**Space_Heating_System**		*space heating system* [new]	technical building system that supplies heat for thermal comfort	EN 15316-1*	string	-	-
	has	**Space_Heating_System_Type**	*type of space heating system* [new]	type of space heating system	-	string	-	-
		is **Main_Space_Heating_System**	-	main space heating system	-	string	-	-
		is **Secondary_Space_Heating_System**	-	secondary space heating system	-	string	-	-
	has	**Space_Heating_Fraction_Of_Heat**	-	fraction of space heated by the space heating system	-	real	-	-
	has	**Space_Heating_System_Efficiency**	*space heating system efficiency* [new]	global efficiency of the space heating system	EN 15316-1*	real	%	-
	has	**Space_Heating_Capacity**	*heat capacity for space heating* [new]	maximum heat addition flowrate of a space heating system under specified conditions	EN 15243*	real	W	-
	has	**Space_Heating_Energy_Carrier**	*energy carrier for space heating* [new]	substance or phenomenon that can be used to produce heat for space heating	EN 15603* EN 15316-1*	string	-	-
		is **Natural_Gas**	-	-	-	string	-	-
		is **Electricity**	-	-	-	string	-	-
		is **Heat**	-	-	-	string	-	-
		is **…**	-	-	-	string	-	-
	has	**Space_Heating_System_Responsiveness**	*system responsiveness of space heating system* [new]		SAP	real	-	-

Name/Acronym	Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
has **Space_Heating_Emission_Subsystem**	*emission subsystem for space heating* [new]	subsystem of the space heating system that provides heat in the conditioned space, including control. It is characterised by non-uniform space temperature distribution, heat emitters embedded in the building structure, control accuracy of the indoor temperature	EN 15316-2-1*	string	-	-
has **Space_Heating_Emission_Subsystem_Type**	*type of emission subsystem for space heating* [new]	type of emission subsystem for space heating	-	string	-	-
has **Space_Heating_Emission_Subsystem_Efficiency**	*efficiency of the emission subsystem for space heating* [new]	ratio between the energy output of the emission subsystem of the space heating system (energy need) and the energy input of the emission subsystem of the space heating system, taking into account the subsystem thermal losses (e.g. non-ideal emission system causing nonuniform temperature distribution and non-ideal room temperature control). The efficiency includes the auxiliary energy	EN 15316-1*	real	-	-
has **Energy_Quantities_Related_To_Technical_Building_System**	-	energy referred to the technical building systems	-	-	-	**"energy_quantities"**
has **Space_Heating_Distribution_Subsystem**	*distribution subsystem for space heating* [new]	subsystem of the space heating system in which energy is transported by a fluid from the heat generation to the heat emission, including control	EN 15316-2-3*	string	-	-
has **Space_Heating_Distribution_Subsystem_Type**	*type of distribution subsystem for space heating* [new]	type of distribution subsystem for space heating	-	string	-	-
has **Space_Heating_Distribution_Subsystem_Efficiency**	*efficiency of the distribution subsystem for space heating* [new]	ratio between the energy output of the distribution subsystem of the space heating system and the energy input of the distribution subsystem of the space heating system, taking into account the subsystem thermal losses and the auxiliary energy	EN 15316-1*	real	-	-
has **Space_Heating_Distribution_Type_Of_Pump**	-	type of pump installed in the distribution subsystem for space heating	-	string	-	-
is **Central_Heating_Pump**	-		SAP	string	-	-
has **Energy_Quantities_Related_To_Technical_Building_System**	-	energy referred to the technical building systems	-	-	-	**"energy_quantities"**
has **Space_Heating_Storage_Subsystem**	*storage subsystem for space heating* [new]	subsystem of the space heating system for storing heat, including control	-	string	-	-
has **Space_Heating_Storage_Subsystem_Type**	*type of storage subsystem for space heating* [new]	type of storage subsystem for space heating	-	string	-	-
has **Energy_Quantities_Related_To_Technical_Building_System**	-	energy referred to the technical building systems	-	-	-	**"energy_quantities"**
has **Space_Heating_Generation_Subsystem**	*generation subsystem for space heating* [new]	subsystem of the space heating system for heat production	-	string	-	-
has **Space_Heating_Generation_Subsystem_Efficiency**	*efficiency of the generation subsystem for space heating* [new]	ratio between the energy output of the generation subsystem of the space heating system and the energy input of the generation subsystem of the space heating system (energy use), taking into account the subsystem thermal losses. The efficiency includes the auxiliary energy	EN 15316-1*	real	-	-
has **Energy_Quantities_Related_To_Technical_Building_System**	-	energy referred to the technical building systems	-	-	-	**"energy_quantities"**
has **Energy_Generator**	-	energy generator system of the building	-	string	-	**"energy_generator"**
is **Domestic_Hot_Water_System**	*domestic hot water system* [new]	heating system that supplies heat to raise the temperature of the cold water to the intended delivery temperature	EN 15316-1*	string	-	-
has **Domestic_Hot_Water_System_Type**	*type of domestic hot water system* [new]	type of domestic hot water system	-	string	-	-
has **Domestic_Hot_Water_System_Efficiency**	*domestic hot water system efficiency* [new]	global efficiency of the entire domestic hot water system	EN 15316-1*	real	-	-

Name/Acronym				Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
	has	**Domestic_Hot_Water_Heat_Capacity**		*heat capacity for domestic hot water* [new]	maximum heat addition flowrate of a domestic hot water system under specified conditions	EN 15243*	real	W	-
	has	**Domestic_Hot_Water_Energy_Carrier**		*energy carrier for domestic hot water* [new]	substance or phenomenon that can be used to produce heat for domestic hot water	EN 15603* EN 15316-1*	string	-	-
		is	**Natural_Gas**	-	-	-	string	-	-
		is	**Electricity**	-	-	-	string	-	-
		is	**Heat**	-	-	-	string	-	-
		is	**...**	-	-	-	string	-	-
	has	**Domestic_Hot_Water_Distribution_Subsystem**		*distribution subsystem for domestic hot water* [new]	distribution pipes installed between the heat generator or hot water storage vessel (if present) and the user outlet or outlets. The domestic hot water distribution system may include a circulation loop and individual sections	EN 15316-3-2	string	-	-
		has	**Domestic_Hot_Water_Distribution_Subsystem_Type**	*type of distribution subsystem for domestic hot water* [new]	type of distribution subsystem for domestic hot water	-	string	-	-
		has	**Domestic_Hot_Water_Distribution_Subsystem_Efficiency**	*efficiency of the distribution subsystem for domestic hot water* [new]	ratio between the energy output of the distribution subsystem of the domestic hot water system and the energy input of the distribution subsystem of the domestic hot water system, taking into account the subsystem thermal losses and the auxiliary energy	EN 15316-1*	real	-	-
		has	**Energy_Quantities_Related_To_Technical_Building_System**	-	energy referred to the technical building systems	-	-	-	**"energy_quantities"**
	has	**Domestic_Hot_Water_Storage_Subsystem**		*storage subsystem for domestic hot water* [new]	subsystem of the domestic hot water system for storing heat, including control	-	string	-	-
		has	**Domestic_Hot_Water_Storage_Subsystem_Type**	*type of storage subsystem for domestic hot water* [new]	type of storage subsystem for domestic hot water	-	string	-	-
		has	**Energy_Quantities_Related_To_Technical_Building_System**	-	energy referred to the technical building systems	-	-	-	**"energy_quantities"**
	has	**Domestic_Hot_Water_Generation_Subsystem**		*generation subsystem for domestic hot water* [new]	subsystem of the domestic hot water system for heat production	-	string	-	-
		has	**Domestic_Hot_Water_Generation_Subsystem_Efficiency**	*efficiency of the generation subsystem for domestic hot water* [new]	ratio between the energy output of the generation subsystem of the domestic hot water system and the energy input of the generation subsystem of the domestic hot water system (energy use), taking into account the subsystem thermal losses. The efficiency includes the auxiliary energy	EN 15316-1*	real	-	-
		has	**Energy_Quantities_Related_To_Technical_Building_System**	-	energy referred to the technical building systems	-	-	-	**"energy_quantities"**
	has	**Energy_Generator**		-	energy generator system of the building	-	string	-	**"energy_generator"**
is	**Space_Cooling_System**			*space cooling system* [new]	technical building system that extracts heat for thermal comfort	EN 15603*	string	-	-
	has	**Space_Cooling_System_Type**		*type of space cooling system* [new]	type of space cooling system	-	string	-	-
	has	**Space_Cooling_System_Efficiency**		*space cooling system efficiency* [new]	global efficiency of the entire space cooling system	EN 15316-1*	real	%	-
	has	**Space_Cooling_Capacity**		*cooling capacity for space cooling* [new]	maximum heat extraction flowrate of a space cooling system under specified conditions	EN 15243*	real	W	-
	has	**Space_Cooling_Energy_Carrier**		*energy carrier for space cooling* [new]	substance or phenomenon that can be used by the space cooling system	-	string	-	-
		is	**Natural_Gas**	-	-	-	string	-	-
		is	**Electricity**	-	-	-	string	-	-
		is	**...**	-	-	-	string	-	-

Name/Acronym				Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
	has	Space_Cooling_Emission_Subsystem		*emission subsystem for space cooling* [new]	subsystem, where the cooling energy is emitted to the space, inclusive control systems	EN 15240	string	-	-
		has	Space_Cooling_Emission_Subsystem_Type	*type of emission subsystem for space cooling* [new]	type of emission subsystem for space cooling	-	string	-	-
		has	Space_Cooling_Emission_Subsystem_Efficiency	*efficiency of the emission subsystem for space cooling* [new]	ratio between the energy output of the emission subsystem of the space cooling system (energy need) and the energy input of the emission subsystem of the space cooling system, taking into account the subsystem thermal losses (e.g. non-ideal emission system causing nonuniform temperature distribution and non-ideal room temperature control). The efficiency includes the auxiliary energy	EN 15316-1*	real	-	-
		has	Energy_Quantities_Related_To_Technical_Building_System	-	energy referred to the technical building systems	-	-	-	"energy_quantities"
	has	Space_Cooling_Distribution_Subsystem		*distribution subsystem for space cooling* [new]	subsystem, where the cooling energy is transported and distributed from the storage subsystem to emission subsystem by a distribution medium, inclusive control systems	EN 15240	string	-	-
		has	Space_Cooling_Distribution_Subsystem_Type	*type of distribution subsystem for space cooling* [new]	type of distribution subsystem for space cooling	-	string	-	-
		has	Space_Cooling_Distribution_Subsystem_Efficiency	*efficiency of the distribution subsystem for space cooling* [new]	ratio between the energy output of the distribution subsystem of the space cooling system and the energy input of the distribution subsystem of the space cooling system, taking into account the subsystem thermal losses and the auxiliary energy	EN 15316-1*	real	-	-
		has	Energy_Quantities_Related_To_Technical_Building_System	-	energy referred to the technical building systems	-	-	-	"energy_quantities"
	has	Space_Cooling_Storage_Subsystem		*storage subsystem for space cooling* [new]	storage subsystem of the space cooling system, including control	-	string	-	-
		has	Space_Cooling_Storage_Subsystem_Type	*type of storage subsystem for space cooling* [new]	type of storage subsystem for space cooling	-	string	-	-
		has	Energy_Quantities_Related_To_Technical_Building_System	-	energy referred to the technical building systems	-	-	-	"energy_quantities"
	has	Space_Cooling_Generation_Subsystem		*generation subsystem for space cooling* [new]	subsystem, where the cooling energy is generated by refrigeration units, inclusive control systems	EN 15240	string	-	-
		has	Space_Cooling_Generation_Subsystem_Efficiency	*efficiency of the generation subsystem for space cooling* [new]	ratio between the energy output of the generation subsystem of the space cooling system and the energy input of the generation subsystem of the space cooling system (energy use), taking into account the subsystem thermal losses. The efficiency includes the auxiliary energy	EN 15316-1*	real	-	-
		has	Energy_Quantities_Related_To_Technical_Building_System	-	energy referred to the technical building systems	-	-	-	"energy_quantities"
	has	Energy_Generator		-	energy generator system of the building	-	string	-	"energy_generator"
is	Ventilation_System			*ventilation system* [new]	technical building system that supplies or removes air by natural or mechanical means to or from a space	EN 15603* EN 15316-1*	string	-	-
	has	Ventilation_System_Type		*type of ventilation system* [new]	type of ventilation system	-	string	-	-
		is	Exhaust_Air_System	-	exhaust air system, continously operated during heating season	TABULA	string	-	-
		is	Balanced_Ventilation_System	-	balanced ventilation system (air exhaust/supply)	TABULA	string	-	-
		is	Balanced_Ventilation_System_Heat_Recovery	-	balanced ventilation system (air exhaust/supply) with heat recovery system	TABULA	string	-	-
		is	Balanced_Ventilation_System_Preheated	-	balanced ventilation system (air exhaust/supply) with ground heat exchanger and heat recovery	TABULA	string	-	-
	has	Ventilation_System_Efficiency		*ventilation system efficiency* [new]	global efficiency of the ventilation system	-	real	%	-
	has	Ventilation_Electrical_Power_Installed		*electrical power installed for ventilation* [new]	eletrical power of the ventilation system	-	real	W	-
	has	Energy_Generator		-	energy generator system of the building	-	string	-	"energy_generator"

Name/Acronym			Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
is	**Lighting_System**		*lighting system* [new]	technical building system that supplies the necessary illumination	EN 15603*	string	-	-
	has	**Lighting_System_Type**	*type of lighting system* [new]	type of lighting system	-	string	-	-
	has	**Lighting_System_Efficiency**	*lighting system efficiency* [new]	global efficiency of the lighting system	-	real	%	-
	has	**Lighting_Electrical_Power_Installed**	*electrical power installed for lighting* [new]	eletrical power from the mains supply consumed by the lamps, control gear and control circuit in or associated with the luminaire	EN 15193	real	W	-
	has	**Number_Of_Fixed_Lighting_Outlets**	-		SAP	integer	-	-
	has	**Number_Of_Fixed_Low_Energy_Outlets**	-		SAP	integer	-	-
	has	**Energy_Generator**	-	energy generator system of the building	-	string	-	**"energy_generator"**
is	**Electrical_Appliances**		*electrical appliances* [new]	various appliances consuming energy	EN 15603*	string	-	-
	has	**Electrical_Appliances_Type**	*type of electrical appliances* [new]	type of electrical appliances	-	string	-	-
	has	**Electrical_Appliances_Power_Installed**	*electrical power installed for electrical appliances* [new]	eletrical power of the electrical appliances	-	real	W	-
	has	**Energy_Generator**	-	energy generator system of the building	-	string	-	**"energy_generator"**
has	**Energy_Quantities_Related_To_Technical_Building_System**		-	energy referred to the technical building systems	-	-	-	**"energy_quantities"**

Table A13. Standard Table *referred to the Excel sheet named "energy_generator"*

Name/Acronym			Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
Energy_Generator			-	energy generator system of the building	-	string	-	**-**
is	**Boiler**		-	a gas or liquid fuelled appliance designed to provide hot water for space heating. It may (but need not) be designed to provide domestic hot water as well	EN 15316-4-1 TABULA	string	-	-
	is	**Boiler_Non-condensing**	-	boiler not so designed, or without the means to remove the condensate in liquid form	EN 15316-4-1 TABULA	string	-	-
	is	**Boiler_Condensing**	-	boiler designed to make use of the latent heat released by condensation of water vapour in the combustion flue products	EN 15316-4-1 TABULA	string	-	-
	is	**Wood-pellets_Boiler**	-	boiler for combustion of wood pellets	TABULA	string	-	-
is	**Water_Heater**		-	heater for domestic hot water	EN 15316-3-3*	string	-	-
	is	**Direct_Gas_Fired_Storage_Water_Heater**	-	-	EN 15316-3-3	string	-	-
	is	**Direct_Electrical_Heated_Storage_Water_Heater**	-	-	EN 15316-3-3	string	-	-

Name/Acronym			Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
is	**Heat_Pump**		-	unitary or split-type assemblies designed as a unit to transfer heat. It includes a vapour compression refrigeration system or a refrigerant/sorbent pair to transfer heat from the source by means of electrical or thermal energy at a high temperature to the heat sink	EN 15316-4-2 TABULA	string	-	-
	is	**Air_Heat_Pump**	-	heat pump using the external air as the heat source	TABULA	string	-	-
	is	**Ground_Heat_Pump**	-	heat pump using the ground as the heat source	TABULA	string	-	-
	is	**Water_Heat_Pump**	-	heat pump using ground water or a water stream as the heat source	TABULA	string	-	-
is	**District_Heating**		-	heat exchanger (heat transfer station, heat substation) of a district heating system	TABULA	string	-	-
is	**District_Cooling**		-	heat exchanger (heat transfer station, heat substation) of a district cooling system	-	string	-	-
is	**Combined_Heat_And_Power_Generator**		-	cogeneration system: combined heat and electric power generator	TABULA	string	-	-
is	**Thermal_Solar_Plant**		-	thermal solar plant	TABULA	string	-	-
	has	**Thermal_Solar_Plant_Collector_Type**	-	type of solar collector of the thermal solar plant	-	string	-	-
	has	**Thermal_Solar_Plant_Collector_Area**	-	area of the solar collector of the thermal solar plant	-	real	m^2	-
	has	**Thermal_Solar_Plant_Collector_Efficiency**	-	efficiency of the solar collector of the thermal solar plant	-	real	%	-
	has	**Thermal_Solar_Plant_Collector_Heat_Loss**	-	heat loss coefficient of the solar collector of the thermal solar plant	-	real	$W/(m^2K)$	-
	has	**Thermal_Solar_Plant_Collector_Orientation**	-	orientation of the solar collector of the thermal solar plant	-	real	°	-
	has	**Thermal_Solar_Plant_Collector_Tilt**	-	tilt of the solar collector of the thermal solar plant	-	real	°	-
	has	**Thermal_Solar_Plant_Collector_Overshading**	-	overshading of the solar collector of the thermal solar plant	-	real	-	-
is	**PVSystem**		-	photovoltaic system	-	string	-	-
	has	**PVSystem_Peak_Power**	-	electrical power of a photovoltaic system with a given surface and for a solar irradiance of 1 kW/m^2 on this surface (at 25 °C)	EN 15316-4-6	real	W	-
	has	**PVSytem_Efficiency**	-	efficiency of the photovoltaic system	-	real	%	-
	has	**PVSystem_Moduls_Area**	-	area of the moduls of the photovoltaic system	-	real	m^2	-
	has	**PVSystem_Moduls_Orientation**	-	orientation of the moduls of the photovoltaic system	-	real	°	-
	has	**PVSystem_Moduls_Tilt**	-	tilt of the moduls of the photovoltaic system	-	real	°	-

Name/Acronym		Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
has	**Energy_Generator_Power**	-	power of the energy generator	-	real	W	-
has	**Energy_Generator_Efficiency**	-	efficiency of the energy generator	-	real	%	-
has	**Energy_Services**	*energy services*	related to the services provided by the technical building systems and by appliances to provide the indoor climate condition, illumination and other services related to the use of the building	UNI TR 16344* EN 15603*	string	-	**"energy_quantities"**
has	**Energy_Quantities_Related_To_Technical_Building_System**	-	energy referred to the technical building systems	-	-	-	**"energy_quantities"**

A.4 Complementary data

Table A14. Standard Table *referred to the Excel sheet named "TIME"*

Name/Acronym			Corresponding Name in D3.1	Description	Reference	Type of data (descriptive / numeric)	Unit	Reference to other sheets
Time_Aggregation_Type			-	type of time aggregation for the determination of the value	-	string	-	-
is	**Average**		-	average value	-	string	-	-
is	**Median**		-	the value that is exceeded for 50% of the time	-	string	-	-
is	**Mode**		-	the value that appears most often	-	string	-	-
is	**Design**		-	design value	-	string	-	-
is	**Maximum**		-	maximum value	-	string	-	-
is	**Minimum**		-	minimum value	-	string	-	-
Time_Aggregation_Period			-	period to which the aggregation for the determination of the value refers	-	string	-	-
is	**Yearly**		-	yearly value	-	string	-	-
is	**Seasonal**		-	seasonal value	-	string	-	-
is	**Monthly**		-	monthly value	-	string	-	-
is	**Weekly**		-	weekly value	-	string	-	-
is	**Daily**		-	daily value	-	string	-	-
is	**Hourly**		-	hourly value	-	string	-	-
Period			-	time to which the value refers	-	string	-	-
has	**Year**		-	value referred to a year	-	integer	-	-
has	**Season**		-	value referred to a season	-	string	-	-
	is	**Winter**	-	value referred to winter	-	string	-	-
	is	**Spring**	-	value referred to spring	-	string	-	-
	is	**Summer**	-	value referred to summer	-	string	-	-
	is	**Autumn**	-	value referred to autumn	-	string	-	-
has	**Month**		-	value referred to a month	-	string	-	-
	is	**January**	-	value referred to January	-	string	-	-
	is	**February**	-	value referred to February	-	string	-	-

Name/Acronym				Corresponding Name in D3.1	Description	Reference	Type of data (descriptive / numeric)	Unit	Reference to other sheets
	is	**March**		-	value referred to March	-	string	-	-
	is	**April**		-	value referred to April	-	string	-	-
	is	**May**		-	value referred to May	-	string	-	-
	is	**June**		-	value referred to June	-	string	-	-
	is	**July**		-	value referred to July	-	string	-	-
	is	**August**		-	value referred to August	-	string	-	-
	is	**September**		-	value referred to September	-	string	-	-
	is	**October**		-	value referred to October	-	string	-	-
	is	**November**		-	value referred to November	-	string	-	-
	is	**December**		-	value referred to December	-	string	-	-
has	**Day**			-	value referred to a day	-	string	-	-
	has	**Type_Of_Day**		-	-	-	string	-	-
		is	**Working_Day**	-	value referred to a working day	-	string	-	-
		is	**Holiday**	-	value referred to holiday	-	string	-	-
	has	**Day_Of_The_Week**		-	value referred to a day of the week	-	string	-	-
		is	**Monday**	-	value referred to Monday	-	string	-	-
		is	**Tuesday**	-	value referred to Tuesday	-	string	-	-
		is	**Wednesday**	-	value referred to Wednesday	-	string	-	-
		is	**Thursday**	-	value referred to Thursday	-	string	-	-
		is	**Friday**	-	value referred to Friday	-	string	-	-
		is	**Saturday**	-	value referred to Saturday	-	string	-	-
		is	**Sunday**	-	value referred to Sunday	-	string	-	-
	has	**Day_Of_The_Month**		-	value referred to a day of the month (from 1 to 31)	-	integer	-	-
	has	**Day_Of_The_Year**		-	value referred to a day of the year (from 1 to 365)	-	integer	-	-
has	**Hour_Of_The_Day**			-	value referred to a specific hour of the day (from 1 to 24)	-	integer	-	-

Table A15. Standard Table *referred to the Excel sheet named "SPACE"*

Name/Acronym		Corresponding Name in D3.1	Description	Reference	Type of data	Unit	Reference to other sheets
Orientation		*orientation* [new]	the direction an envelope element faces, i.e. the direction of a vector perpendicular to and pointing away from the surface outside of the element	ANSI/ASHRAE 90.1	-	-	**-**
is	**North**	-	element facing north direction	ANSI/ASHRAE 90.1*	string	-	-
is	**South**	-	element facing south direction	ANSI/ASHRAE 90.1*	string	-	-
is	**East**	-	element facing east direction	ANSI/ASHRAE 90.1*	string	-	-
is	**West**	-	element facing west direction	ANSI/ASHRAE 90.1*	string	-	-
is	**North-East**	-	element facing north-east direction	ANSI/ASHRAE 90.1*	string	-	-
is	**North-West**	-	element facing north-west direction	ANSI/ASHRAE 90.1*	string	-	-
is	**South-East**	-	element facing south-east direction	ANSI/ASHRAE 90.1*	string	-	-
is	**South-West**	-	element facing south-west direction	ANSI/ASHRAE 90.1*	string	-	-
has	**Azimut_Angle**	-	angle on a horizontal plane between the normal to the surface and the north-south direction line	-	real	rad	-
has	**Tilt_Angle**	-	angle between the plane cointaining the surface and the horizontal plane	-	real	rad	-
Scale		-	level of application	-	string	-	**-**
is	**Building**	-	construction as a whole, including its envelope and all technical building systems, for which energy is used to condition the indoor climate, to provide domestic hot water and illumination and other services related to the use of the building	EN 15603	string	-	**"building"**
is	**Neighbourhood**	-	-	-	string	-	**-**
is	**City**	-	-	-	string	-	**-**
is	**Region**	-	-	-	string	-	**-**

APPENDIX B. Mapping tables

B.1 Data sources mapping

The mapping table template on data sources is shown in Table B1.

Table B1. Template of the mapping table on data sources

Data source	Data name (in the Data source)	Data name (according to D3.1)	Data category (according to D3.1)

B.2 Tools input data mapping

The mapping table template on tools input data is shown in Table B2.

An example of this table is provided by the Manresa case study (see Table B3).

Table B2. Template of the mapping table on tools input data

Tool	Input data name (in the Tool)	Input data name (according to D3.1)	Data category (according to D3.1)

Table B3. Mapping table on tools input data – Manresa case study

Tool	Input data name (in the Tool)	Input data name (according to D3.1)	Data category (according to D3.1)
Ursos	Edición de puntos	Buildings coordinates	Building technical data
Ursos	Altura	Height	Building technical data
Ursos	Número de plantas de la base	Number of floors	Building technical data
Ursos	Orientación TED	Orientation of the building	Building technical data
Ursos	T. confort invierno	Indoor air temperature (space heating)	Climatic data
Ursos	T. confort verano	Indoor air temperature (cooling)	Climatic data
Ursos	Tasa renovación	Air change coefficient	Building technical data
Ursos	Ganancia interna	Internal gains coefficient	Building technical data
Ursos	Ocupación	Percentage of occupation	Building technical data
Ursos	Tipo de uso	Building use	Building technical data
Ursos	% viviendas con posibilidad de ventilación cruzada nocturna	Percentage of household with night cross ventilation	Not classified data
Ursos	% viviendas con posibilidad de ventilación a 90º	Percentage households with cross ventilation at 90º	Not classified data
Ursos	Nombre	Name of enclosure	Not classified data
Ursos	U del muro	Wall U-value	Building technical data
Ursos	% huecos	Windows area	Building technical data

Tool	Input data name (in the Tool)	Input data name (according to D3.1)	Data category (according to D3.1)
Ursos	U Huecos	Window U Value	Building technical data
Ursos	Factor solar	Window g-value	Building technical data
Ursos	Absortividad	Absorptivity of walls	Building technical data
Ursos	Con alero	Overhangs	Building technical data
Ursos	Altura	Window height	Not classified data
Ursos	Anchura	Window width	Not classified data
Ursos	Retranqueo	Window setback (is this the window depth being referred to? If so, change to "depth")	Not classified data
Ursos	DAS	DAS	Not classified data
Ursos	ASS	ASS	Not classified data
Ursos	DAD	DAD	Not classified data
Ursos	ADD	ADD	Not classified data
Ursos	DAI	DAI	Not classified data
Ursos	AAI	AAI	Not classified data
Ursos	Cobertura anual de ACS con solar térmica	Annual coverage of sanitary hot water with solar thermal	Not classified data
Ursos	Producción eléctrica origen removable	Renewable electricity	Not classified data

Tool	Input data name (in the Tool)	Input data name (according to D3.1)	Data category (according to D3.1)
Ursos	Tierras excavadas aprovechadas en el lugar	Excavated soil exploited in place	Not classified data
Ursos	Tipo de suelo	Land quality	Land and buildings registry data
Ursos	Tipo combustible para calefacción	Energy carrier – space heating	Building technical data
Ursos	Redimiento del sistema de calefacción	Efficiency - space heating	Building technical data
Ursos	Tipo combustible para refrigeración	Energy carrier - cooling	Building technical data
Ursos	Redimiento del sistema de refrigeración	Efficiency - cooling	Building technical data
Ursos	Tipo combustible para ACS	Energy carrier – sanitary hot water	Not classified data
Ursos	Hay elementos reductores de caudal	Water flow reduction	Building technical data
Ursos	Hay WC con doble descarga	Double discharge WC	Not classified data
Ursos	Empleo de agua no potable - Lavadora	Use of non-drinkable water – washing machine	Not classified data
Ursos	Empleo de agua no potable - WC	Use of non-drinkable water – WC	Not classified data
Ursos	Uso materiales ecológicos - % de uso	% of ecological materials	
Ursos	Uso materiales reciclados - % de uso	% of recycled materials	
Ursos	Horizonte	Horizon profile	Not classified data
Ursos	Ciudad	City	Not classified data
Ursos	Latitud	Latitude	Not classified data

Tool	Input data name (in the Tool)	Input data name (according to D3.1)	Data category (according to D3.1)
Ursos	Radiación	Global solar radiation	Climatic data
Ursos	T. Máxima	Maximum air temperature	Climatic data
Ursos	T. Mínima	Minimum air temperature	Climatic data