Intelligent Energy Europe Projects TABULA + EPISCOPE

Introduction to the Excel Workbook TABULA.xlsm

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1 General Remarks / Purpose of the Workbook

The workbook TABULA.xlsm is designed to perform the following tasks:

A.	**"Data Base":**	Frame for collecting and merging typology data from different countries
B.	**"Programming Template":**	Structure template and data source for the TABULA WebTool
C.	**"Showcase Calculation":**	Display of the common energy performance procedure / check of input data
D.	**"Operative Analyses":**	Energy performance calculation of sets of buildings/systems (calculation sheets with n rows)

Please, keep in mind that the purpose of the TABULA data structure is to facilitate the understanding of typical buildings, supply systems and refurbishment measures in the different European countries and to lay the basis for scenario calculations on a supranational level.

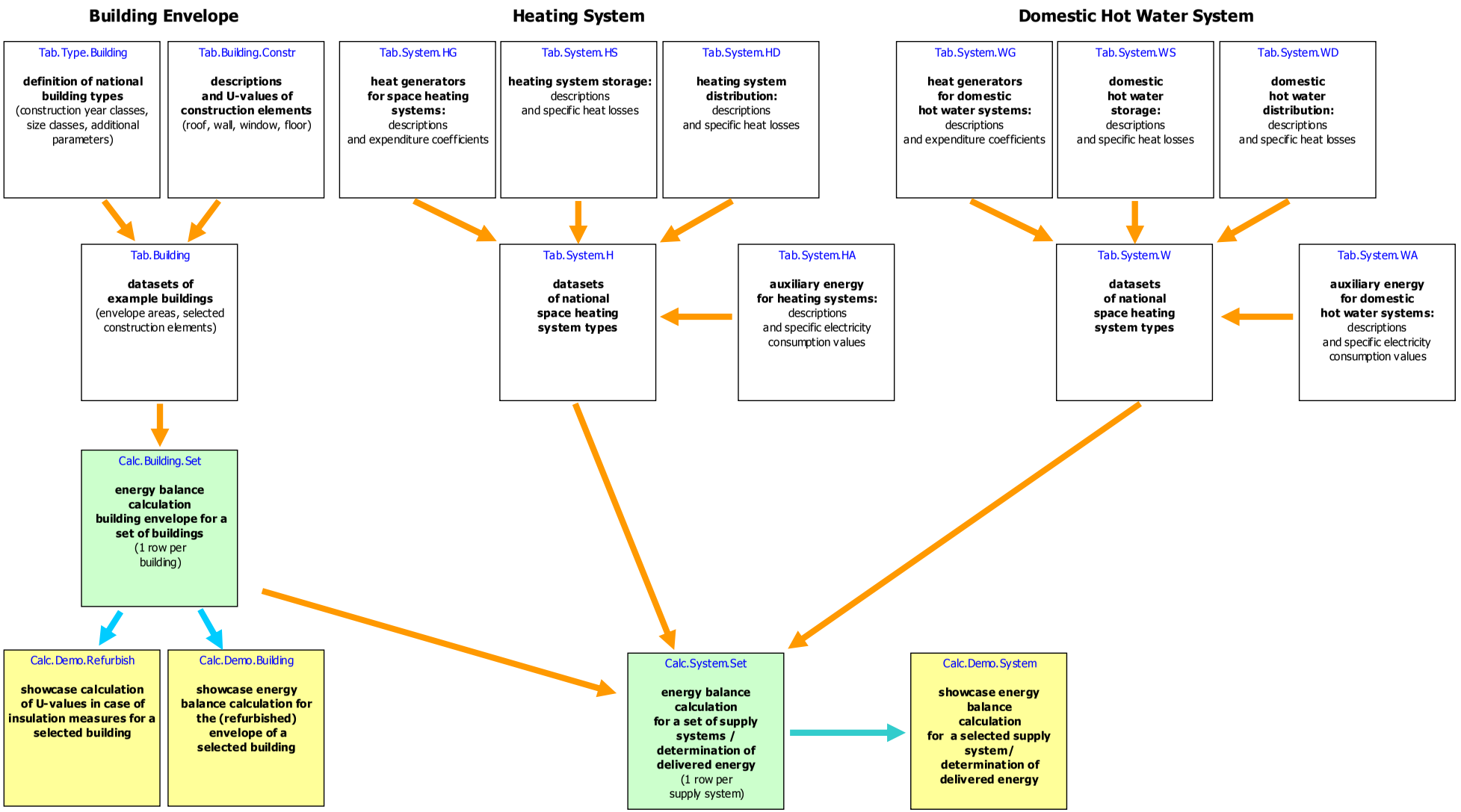
It is not the intention to adapt this Excel workbook to national regulations. For your national calculations you will generally use your own tools (e.g. calculating the energy saving for the National Typology Brochures) and publish the building and system datasets with respect to your national standards.

In consequence, there are always two definitions for each national typology and thus two sets of datasets representing the same example buildings and systems: a national and a TABULA version ("two sides of the same coin"). It is the task of the caretakers of each national building typology to elaborate and publish the datasets according to the respective national definitions and to establish the transformation to the common TABULA database.

2 Overview of the most important sheets

The following picture shows the main definition tables (Tab.*) and calculations sheets (Calc.*).

Overview of the main definition tables (Tab.*) and calculation sheets (Calc.*)



3 Working with TABULA.xlsm

Due to the fact that the workbook is the template for the TABULA-WebTool there are a lot of tables which serve as a basis for the internet programming work. In order to keep track of the essentials it is possible to hide those sheets which are not necessary for a given task. This can be done by clicking on one of the “Show Modes” at the sheet “Info”.

➢ Sheet “Info”

Show Mode (Hide / Unhide Sheets)

- ○ **Building Type Definition**
- ○ **System Type Definition**
- ○ **Calculation of Building and System Performance (n datasets)**
- ○ **Showcase Calculation of Building and System Performance (1 dataset)**
- ◉ **Standard Working Mode: Data Input and Calculation Sheets**
- ○ **All Sheets including Definitions of Constants**
- ○ **All Sheets including Definitions of Constants and Control Sheets**

Double klick on sheet name for immediate access.

Name	Type	Content	Show
Info	information	overview of this workbook and typology structure	show
Log.Changes	system	Changes and remaining tasks	hide
Dev.Tasks	system	development: tasks (internal list)	hide
Definitions	system	overview of all data fields	hide
Settings	system	internal settings	hide
Tab.Control.Sheet	system	internal sheet control	hide
Dev.Tab.TEST	national definitions	development: test sheet	hide
Tab.Info.Country	statistics	frequencies of data input for several sheets	show
Tab.Const.DataFormat	constants	data format codes	hide
Tab.Const.StatusDataset	constants	dataset status codes	hide
Tab.Const.DataType.Building	constants	building data type	hide
Tab.Const.Country	constants	country codes	hide
Tab.Const.Language	constants	language codes	hide
Tab.Const.BuildingSizeClass	constants	national building size classes	hide
Tab.Const.BoundaryCondType	constants	type of boundary condition input	hide
Tab.Const.Utilisation	constants	common definitions of utilisation types	hide
Tab.Const.RoofType	constants	roof type codes	hide
Tab.Const.AtticCond	constants	space heating situation of the attic storey	hide
Tab.Const.CellarCond	constants	space heating situation of the cellar storey	hide
Tab.Const.AttNeighb	constants	number of attached neighbour buildings	hide
Tab.Const.ThermalBridging	constants	classification of thermal bridging	hide
Tab.Const.Infiltration	constants	classification of airtightness	hide
Tab.Const.ConstrBorder	constants	type of construction border	hide
Tab.Const.ElementType	constants	type of thermal envelope elements	hide
Tab.Const.MeasureType	constants	type of refurbishment measure / replacement of existing insulation or elements	hide
Tab.Const.EnergyCarrier	constants	codes for the used energy carriers	hide
Tab.Const.SysType.HG	constants	heating system: generator types	hide
Tab.Const.SysType.HS	constants	heating system: storage types	hide
Tab.Const.SysType.HD	constants	heating system: distribution and heat emission types	hide
Tab.Const.SysType.HA	constants	heating system: auxiliary energy types	hide
Tab.Const.SysType.Vent	constants	heating system: ventilation types	hide
Tab.Const.SysType.WG	constants	domestic hot water system: generator types	hide
Tab.Const.SysType.WS	constants	domestic hot water system: storage types	hide
Tab.Const.SysType.WD	constants	domestic hot water system: distribution types	hide
Tab.Const.SysType.WA	constants	domestic hot water system: auxiliary energy types	hide
Tab.Const.SysType.Size	constants	building types used to distinguish between different system component sizes	hide
Tab.Const.Type.CalcAdapt	constants	calculation adaptation types	hide
Tab.TypologyRegion	national definitions	national typology regions	show
Tab.ConstrYearClass	national definitions	national construction year classes	show
Tab.AdditionalPar	national definitions	national addtitional parameter for classification (regions, special building types etc.)	show
Tab.Climate	national definitions	national and regional climate conditions	show
Tab.AuxCalc.Climate	auxiliary calculation	Auxiliary Calculation: Determination of heating season values from monthly data (results can l	show
Tab.BoundaryCond	national definitions	boundary conditions for the energy balance calculation	show
Tab.Building.Constr	national definitions	national definition of construction elements + U-values	show
Tab.Building.Measure	national definitions	national definition of insulation measures + thermal resistance	show
Tab.System.HG	national definitions	heating system / generation	show
Tab.System.HS	national definitions	heating system / storage	show
Tab.System.HD	national definitions	heating system / distribution	show
Tab.System.HA	national definitions	heating system / auxiliary energy	show
Tab.System.WG	national definitions	domestic hot water system / generation	show
Tab.System.WS	national definitions	domestic hot water system / storage	show
Tab.System.WD	national definitions	domestic hot water system / distribution	show
Tab.System.WA	national definitions	domestic hot water system / auxiliary energy	show
Tab.System.H	national definitions	datasets of heating system types	show
Tab.System.W	national definitions	datasets of domestic hot water system types	show
Tab.System.Vent	national definitions	datasets of heating system types	show
Tab.System.EC	national definitions	datasets of energy carrier specifications	show
Tab.CalcAdapt	national definitions	definitions of calculation adaptations	show
Tab.Type.Building	national definitions	datasets of national building types	show
Tab.Building	national definitions	datasets of national building types	show
Tab.Type.System	national definitions	definitions of heat supply system types	show
Tab.System.Measure	national definitions	assignment of supply system types to levels of measures	show
Calc.Building.Set	calculation	energy need for heating (1 row per building type)	show
Calc.System.Set	calculation	system efficiency (1 row per system type)	show
Output.Set.1	output	results / interface for other applications	show
Calc.Demo.Refurbish	demonstration calculation	U-value reduction by insulation measures (showcase: 1 building)	show
Calc.Demo.Building	demonstration calculation	energy need for heating (showcase: 1 building)	show
Calc.Demo.System	demonstration calculation	system efficiency (showcase: 1 building)	show

The colour of the cells indicate the cell type (see below). Please, fill in data only in cells which are highlighted yellow:

Cell types

1001	standard input cell
class1	input by selection of a list
0,001	standard calculation cell (formula or values should not be changed)
0,999	calculation cell, formula can be changed
0	calculation cell with reference to other sheets
0,34	cell with constant (fixed value)
pink font	work zone information / preliminary text or formulas / to be elaborated

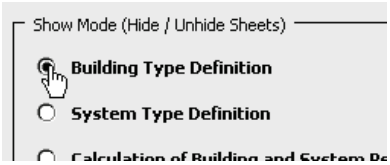
All data tables and calculation sheets are designed in a manner which allows to copy/paste or delete entire rows (with exception of the "demo" calculation sheets). Each sheet has a header of 10 rows containing datafield names, explanations and references. It is not recommended to make changes in these headers.

4 Definition of Building Types

In the following the procedure will be shown for two example buildings of a test country (country code "xx"). When making the definitions for your own country you should use the respective country code (e.g. "FR" in case of France).

➢ Sheet "Info"

Select the Show Mode "Building Type Definition"



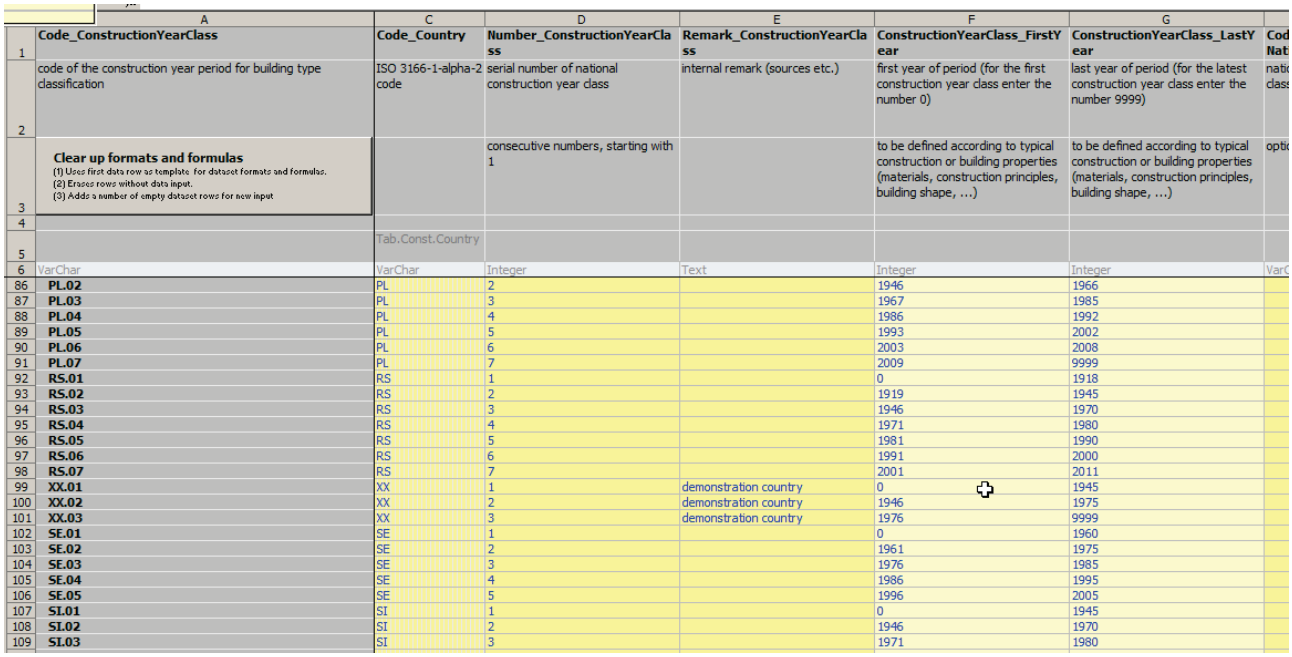
➢ Sheet "Tab.TypologyRegion"

Go to the sheet "Tab.TypologyRegion" and define your national typology region (similar to the example: "xx.n"). For the first test the definition of the national level is sufficient (code: "*.n")

	A	B	C	D	E	F
1	**Code_TypologyRegion**	**Code_StatusDataset**	**Code_Country**	**ShortCut_TypologyRegion**	**Name_TypologyRegion**	**Code_National_TypologyRegion**
2	code of the typology region for building type classification	code of the dataset status	ISO 3166-1-alpha-2 code	shortcut of the typology region	name of the typology region	code of the typology region, national langu
3	**Clear up formats and formulas** (1) Uses first data row as template for dataset formats and formulas. (2) Erases rows without data input. (3) Adds a number of empty dataset rows for new input			in English, if applicable	in English, if applicable	
4						
5		Tab.Const.StatusDataset	Tab.Const.Country			
6	VarChar	VarChar	VarChar	VarChar	VarChar	VarChar
41	**IT.MidClim**	Typology	IT	MidClim	Middle Climatic Zone	ClimMedia
42	**IT.Alpine**	Typology	IT	Alpine	Alpine Zone	Alpina
43	**IT.Mediterranean**	Typology	IT	Mediterranean	Mediterranean Zone	Mediterranea
44	**PL.N**	Typology	PL	N	National	PL
45	**RS.N**	Typology	RS	N	Serbia	SRB
46	**XX.N**	Demonstration	XX		Test Country	
47	**SE.N**	Typology	SK		National	
48	**SE.Zone1**	Typology	SM	ne1	Climatic Zone I	Klimatzone I
49	**SE.Zone2**	Typology	UA	ne2	Climatic Zone II	Klimatzone II
50	**SE.Zone3**	Typology	UK	ne3	Climatic Zone III	Klimatzone III
51	**SI.N**	Typology	VA		National	SI
52	.		XX			
53	.		EU			
54	.		##			

➢ Sheet “Tab.ConstrYearClass”

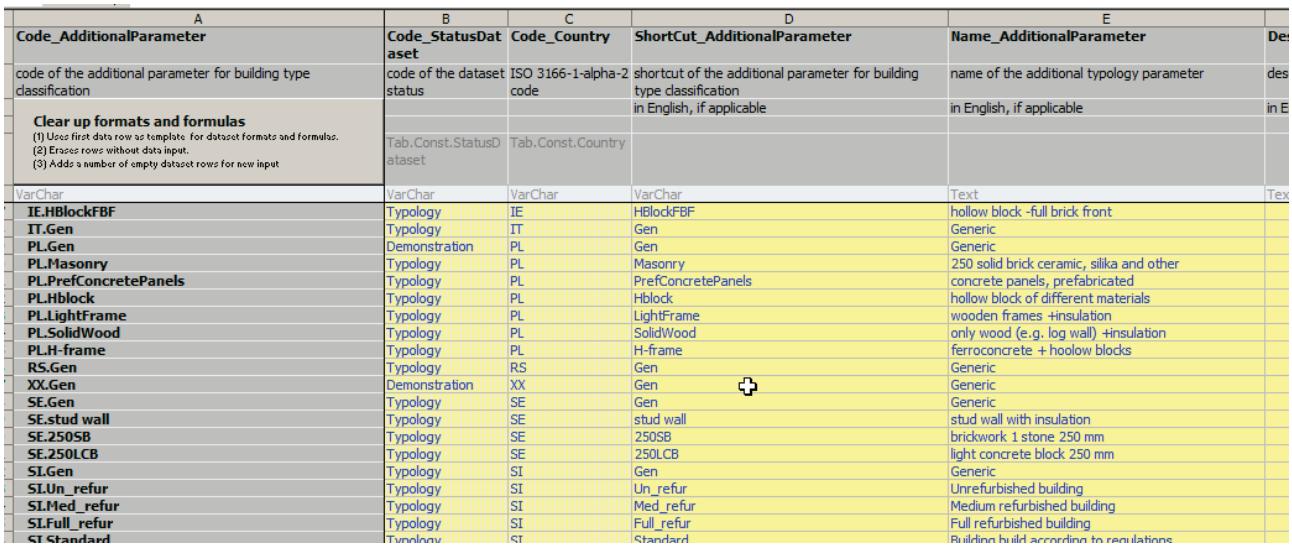
Select the sheet “Tab.ConstrYearClass” and define the respective periods (see example for country xx in the picture).



	A	C	D	E	F	G
1	**Code_ConstructionYearClass**	**Code_Country**	**Number_ConstructionYearClass**	**Remark_ConstructionYearClass**	**ConstructionYearClass_FirstYear**	**ConstructionYearClass_LastYear**
2	code of the construction year period for building type classification	ISO 3166-1-alpha-2 code	serial number of national construction year class	internal remark (sources etc.)	first year of period (for the first construction year class enter the number 0)	last year of period (for the latest construction year class enter the number 9999)
3	**Clear up formats and formulas** (1) Uses first data row as template for dataset formats and formulas. (2) Erases rows without data input. (3) Adds a number of empty dataset rows for new input		consecutive numbers, starting with 1		to be defined according to typical construction or building properties (materials, construction principles, building shape, ...)	to be defined according to typical construction or building properties (materials, construction principles, building shape, ...)
4						
5		Tab.Const.Country				
6	VarChar	VarChar	Integer	Text	Integer	Integer
86	**PL.02**	PL	2		1946	1966
87	**PL.03**	PL	3		1967	1985
88	**PL.04**	PL	4		1986	1992
89	**PL.05**	PL	5		1993	2002
90	**PL.06**	PL	6		2003	2008
91	**PL.07**	PL	7		2009	9999
92	**RS.01**	RS	1		0	1918
93	**RS.02**	RS	2		1919	1945
94	**RS.03**	RS	3		1946	1970
95	**RS.04**	RS	4		1971	1980
96	**RS.05**	RS	5		1981	1990
97	**RS.06**	RS	6		1991	2000
98	**RS.07**	RS	7		2001	2011
99	**XX.01**	XX	1	demonstration country	0	1945
100	**XX.02**	XX	2	demonstration country	1946	1975
101	**XX.03**	XX	3	demonstration country	1976	9999
102	**SE.01**	SE	1		0	1960
103	**SE.02**	SE	2		1961	1975
104	**SE.03**	SE	3		1976	1985
105	**SE.04**	SE	4		1986	1995
106	**SE.05**	SE	5		1996	2005
107	**SI.01**	SI	1		0	1945
108	**SI.02**	SI	2		1946	1970
109	**SI.03**	SI	3		1971	1980

➢ Sheet “Tab.Additional.Par”

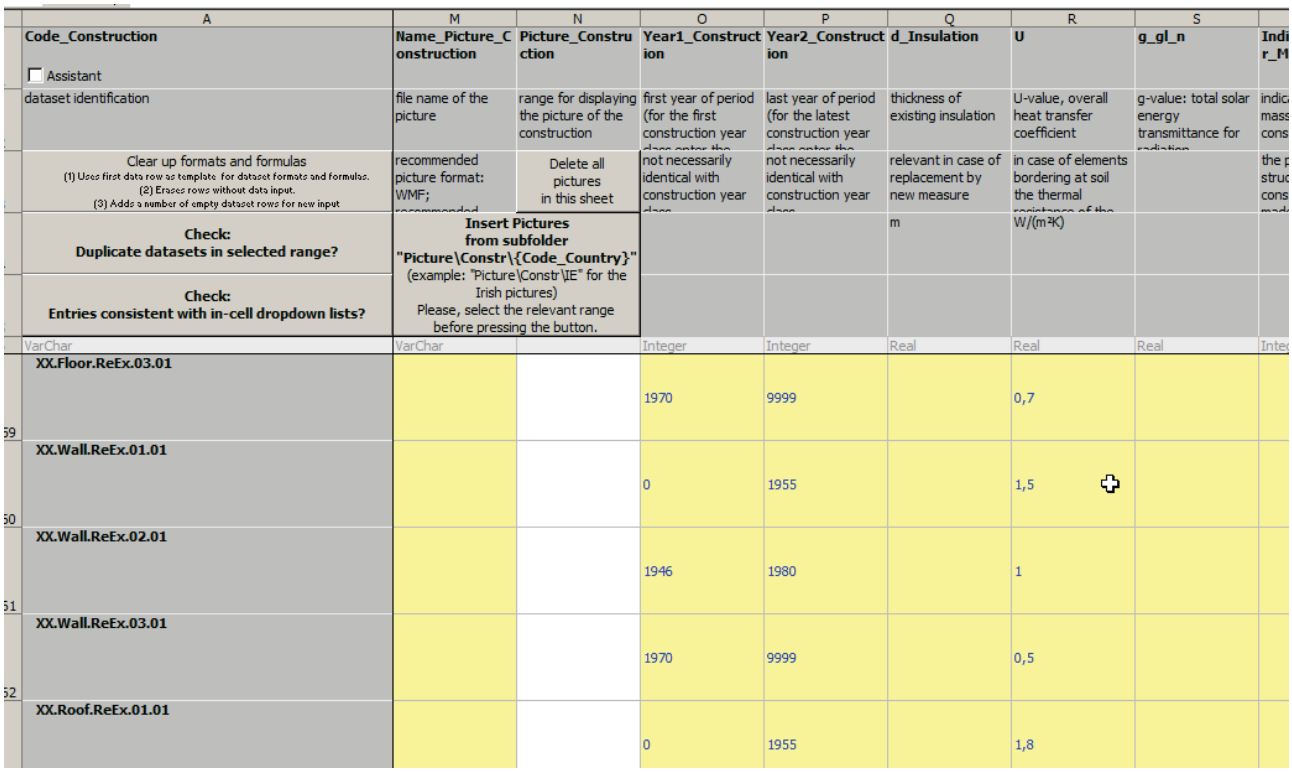
Select the sheet “Tab.Additional.Par” and define at least the generic type (code: “*.gen”). This parameter can later be used to define sub-categories for the building type, for example in order to distinguish between end-terrace and mid-terrace buildings and/or for special building types (e.g. prefabricated).



A	B	C	D	E
Code_AdditionalParameter	**Code_StatusDataset**	**Code_Country**	**ShortCut_AdditionalParameter**	**Name_AdditionalParameter**
code of the additional parameter for building type classification	code of the dataset status	ISO 3166-1-alpha-2 code	shortcut of the additional parameter for building type classification	name of the additional typology parameter
Clear up formats and formulas (1) Uses first data row as template for dataset formats and formulas. (2) Erases rows without data input. (3) Adds a number of empty dataset rows for new input			in English, if applicable	in English, if applicable
	Tab.Const.StatusDataset	Tab.Const.Country		
VarChar	VarChar	VarChar	VarChar	Text
IE.HBlockFBF	Typology	IE	HBlockFBF	hollow block -full brick front
IT.Gen	Typology	IT	Gen	Generic
PL.Gen	Demonstration	PL	Gen	Generic
PL.Masonry	Typology	PL	Masonry	250 solid brick ceramic, silika and other
PL.PrefConcretePanels	Typology	PL	PrefConcretePanels	concrete panels, prefabricated
PL.Hblock	Typology	PL	Hblock	hollow block of different materials
PL.LightFrame	Typology	PL	LightFrame	wooden frames +insulation
PL.SolidWood	Typology	PL	SolidWood	only wood (e.g. log wall) +insulation
PL.H-frame	Typology	PL	H-frame	ferroconcrete + hoolow blocks
RS.Gen	Typology	RS	Gen	Generic
XX.Gen	Demonstration	XX	Gen	Generic
SE.Gen	Typology	SE	Gen	Generic
SE.stud wall	Typology	SE	stud wall	stud wall with insulation
SE.250SB	Typology	SE	250SB	brickwork 1 stone 250 mm
SE.250LCB	Typology	SE	250LCB	light concrete block 250 mm
SI.Gen	Typology	SI	Gen	Generic
SI.Un_refur	Typology	SI	Un_refur	Unrefurbished building
SI.Med_refur	Typology	SI	Med_refur	Medium refurbished building
SI.Full_refur	Typology	SI	Full_refur	Full refurbished building
SI.Standard	Typology	SI	Standard	Building build according to regulations

➢ Sheet “Tab.Building.Constr”

Select the sheet “Tab.Building.Constr” and define at least 1 roof, 1 wall, 1 floor, 1 window and 1 door and type in the respective U-values. *Later all typical construction elements from your country will have to be mentioned here.*



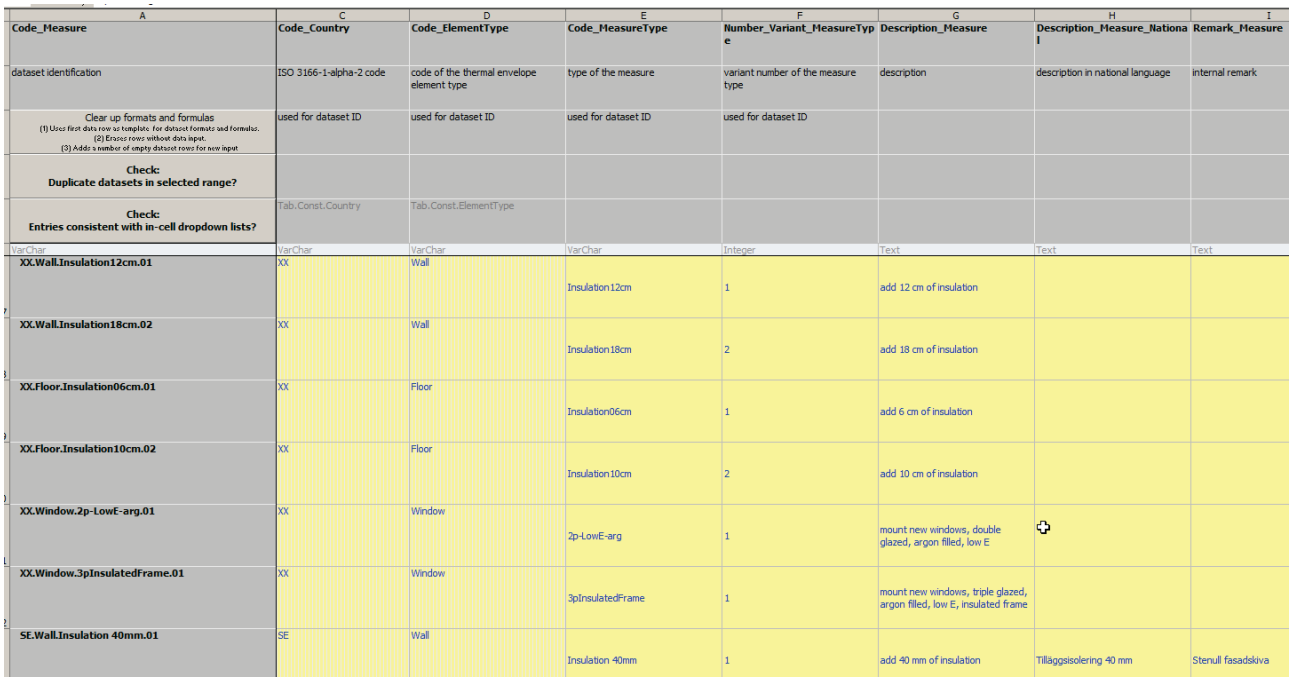
	A	M	N	O	P	Q	R	S	
	Code_Construction ☐ Assistant	**Name_Picture_Construction**	**Picture_Construction**	**Year1_Construction**	**Year2_Construction**	**d_Insulation**	**U**	**g_gl_n**	**Indir_M**
	dataset identification	file name of the picture	range for displaying the picture of the construction	first year of period (for the first construction year	last year of period (for the latest construction year	thickness of existing insulation	U-value, overall heat transfer coefficient	g-value: total solar energy transmittance for	indic mass cons
	Clear up formats and formulas (1) Uses first data row as template for dataset formats and formulas. (2) Erases rows without data input. (3) Adds a number of empty dataset rows for new input	recommended picture format: WMF;	Delete all pictures in this sheet	not necessarily identical with construction year	not necessarily identical with construction year	relevant in case of replacement by new measure	in case of elements bordering at soil the thermal		the p struc cons
	Check: Duplicate datasets in selected range?	**Insert Pictures from subfolder "Picture\Constr\{Code_Country}"** (example: "Picture\Constr\IE" for the Irish pictures) Please, select the relevant range before pressing the button.				m	W/(m²K)		
	Check: Entries consistent with in-cell dropdown lists?								
	VarChar	VarChar		Integer	Integer	Real	Real	Real	Inte
59	**XX.Floor.ReEx.03.01**			1970	9999		0,7		
60	**XX.Wall.ReEx.01.01**			0	1955		1,5		
61	**XX.Wall.ReEx.02.01**			1946	1980		1		
62	**XX.Wall.ReEx.03.01**			1970	9999		0,5		
	XX.Roof.ReEx.01.01			0	1955		1,8		

➢ Sheet “Tab.Building.Measure”

Select the sheet “Tab.Building.Measure” and define some refurbishment measures in the way shown by the examples. There are 3 ways for data input:

1. U-value of construction, input in case of element exchange (especially windows)
2. thermal resistance of applied insulation measures, manual input in case that the thermal resistance is calculated by use of other procedures
3. input of insulation layer thickness and lambda / calculation according to EN ISO 6946 (2 layers, 2 ranges)

Later you will be asked to fill this list with “typical” and “advanced” refurbishment measures.

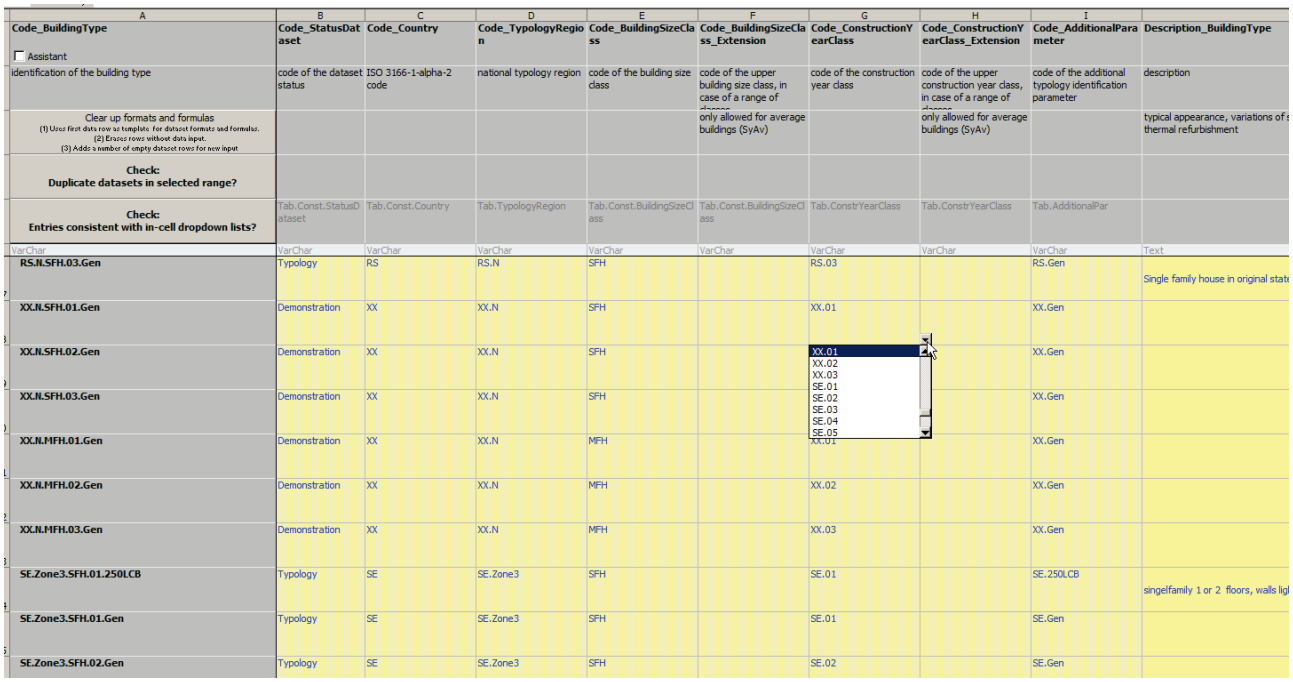


	A	C	D	E	F	G	H	I
	Code_Measure	**Code_Country**	**Code_ElementType**	**Code_MeasureType**	**Number_Variant_MeasureType**	**Description_Measure**	**Description_Measure_National**	**Remark_Measure**
	dataset identification	ISO 3166-1-alpha-2 code	code of the thermal envelope element type	type of the measure	variant number of the measure type	description	description in national language	internal remark
	Clear up formats and formulas (1) Uses first data row as template for dataset formats and formulas. (2) Erases rows without data input. (3) Adds a number of empty dataset rows for new input	used for dataset ID	used for dataset ID	used for dataset ID	used for dataset ID			
	Check: Duplicate datasets in selected range?							
	Check: Entries consistent with in-cell dropdown lists?	Tab.Const.Country	Tab.Const.ElementType					
	VarChar	VarChar	VarChar	VarChar	Integer	Text	Text	Text
	XX.Wall.Insulation12cm.01	XX	Wall	Insulation12cm	1	add 12 cm of insulation		
	XX.Wall.Insulation18cm.02	XX	Wall	Insulation18cm	2	add 18 cm of insulation		
	XX.Floor.Insulation06cm.01	XX	Floor	Insulation06cm	1	add 6 cm of insulation		
	XX.Floor.Insulation10cm.02	XX	Floor	Insulation10cm	2	add 10 cm of insulation		
	XX.Window.2p-LowE-arg.01	XX	Window	2p-LowE-arg	1	mount new windows, double glazed, argon filled, low E		
	XX.Window.3pInsulatedFrame.01	XX	Window	3pInsulatedFrame	1	mount new windows, triple glazed, argon filled, low E, insulated frame		
	SE.Wall.Insulation 40mm.01	SE	Wall	Insulation 40mm	1	add 40 mm of insulation	Tilläggsisolering 40 mm	Stenull fasadskiva

➢ Sheet “Tab.Type.Building”

Select the sheet “Tab.Building.Type” and define 2 building types, e.g. a single-family house and an apartment building (in a similar way as the test country xx).

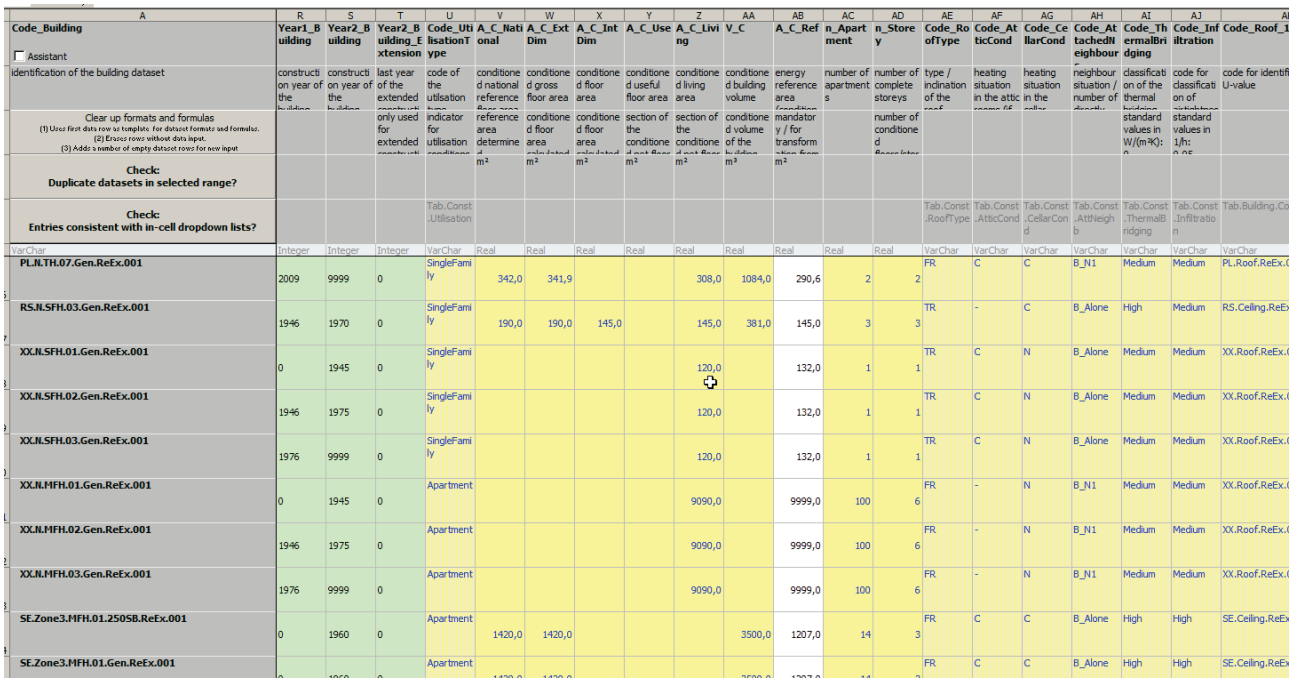
At a later stage it will be necessary to define all building types according to the national building type matrix (http://www.building-typology.eu/downloads/public/calc/BuildingTypeMatrix.zip).



A	B	C	D	E	F	G	H	I	
Code_BuildingType ☐ Assistant	**Code_StatusDataset**	**Code_Country**	**Code_TypologyRegion**	**Code_BuildingSizeClass**	**Code_BuildingSizeClass_Extension**	**Code_ConstructionYearClass**	**Code_ConstructionYearClass_Extension**	**Code_AdditionalParameter**	**Description_BuildingType**
identification of the building type	code of the dataset status	ISO 3166-1-alpha-2 code	national typology region	code of the building size class	code of the upper building size class, in case of a range of	code of the construction year class	code of the upper construction year class, in case of a range of	code of the additional typology identification parameter	description
Clear up formats and formulas (1) Uses first data row as template for dataset formats and formulas. (2) Erases rows without data input. (3) Adds a number of empty dataset rows for new input					only allowed for average buildings (SyAv)		only allowed for average buildings (SyAv)		typical appearance, variations of s thermal refurbishment
Check: Duplicate datasets in selected range?									
Check: Entries consistent with in-cell dropdown lists?	Tab.Const.StatusDataset	Tab.Const.Country	Tab.TypologyRegion	Tab.Const.BuildingSizeClass	Tab.Const.BuildingSizeClass	Tab.ConstrYearClass	Tab.ConstrYearClass	Tab.AdditionalPar	
VarChar	VarChar	VarChar	VarChar	VarChar	VarChar	VarChar	VarChar	VarChar	Text
RS.N.SFH.03.Gen	Typology	RS	RS.N	SFH		RS.03		RS.Gen	Single family house in original stat
XX.N.SFH.01.Gen	Demonstration	XX	XX.N	SFH		XX.01		XX.Gen	
XX.N.SFH.02.Gen	Demonstration	XX	XX.N	SFH		XX.01		XX.Gen	
XX.N.SFH.03.Gen	Demonstration	XX	XX.N	SFH		XX.02 XX.03 SE.01 SE.02 SE.03 SE.04 SE.05		XX.Gen	
XX.N.MFH.01.Gen	Demonstration	XX	XX.N	MFH		XX.01		XX.Gen	
XX.N.MFH.02.Gen	Demonstration	XX	XX.N	MFH		XX.02		XX.Gen	
XX.N.MFH.03.Gen	Demonstration	XX	XX.N	MFH		XX.03		XX.Gen	
SE.Zone3.SFH.01.250LCB	Typology	SE	SE.Zone3	SFH		SE.01		SE.250LCB	singelfamily 1 or 2 floors, walls lig
SE.Zone3.SFH.01.Gen	Typology	SE	SE.Zone3	SFH		SE.01		SE.Gen	
SE.Zone3.SFH.02.Gen	Typology	SE	SE.Zone3	SFH		SE.02		SE.Gen	

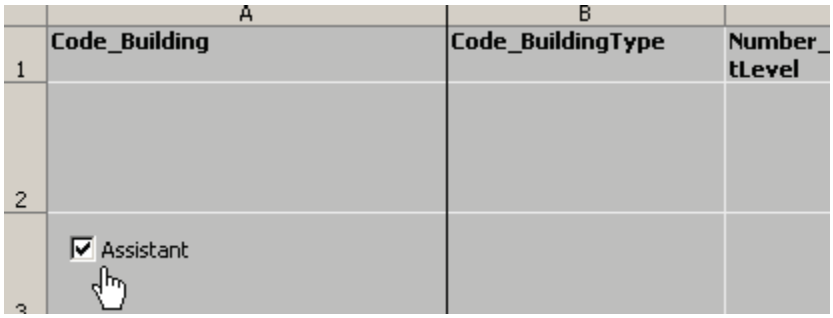
➢ Sheet “Tab.Building”

The thermal envelope of example buildings is defined in this sheet. For each building type defined in "Tab.Type.Building" at least one example building must be entered here.

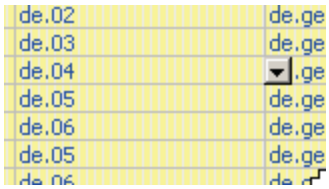


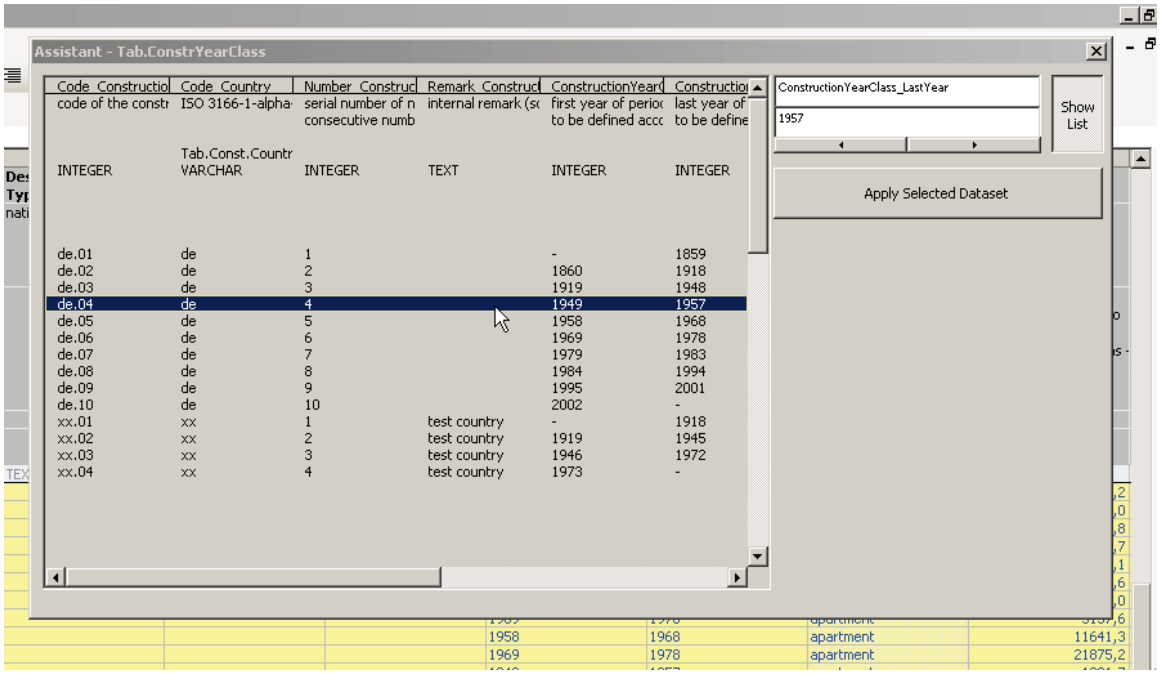
A	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK
Code_Building ☐ Assistant	**Year1_Building**	**Year2_Building**	**Year2_Building_Extension**	**Code_UtilisationType**	**A_C_National**	**A_C_ExtDim**	**A_C_IntDim**	**A_C_Use**	**A_C_Living**	**V_C**	**A_C_Ref**	**n_Apartment**	**n_Storey**	**Code_RoofType**	**Code_AtticCond**	**Code_CellarCond**	**Code_AttachedNeighbour**	**Code_ThermalBridging**	**Code_Infiltration**	**Code_Roof_1**
identification of the building dataset	construction year of the	construction year of the	last year of the extended	code of the utilisation	conditioned national reference	conditioned gross floor area	conditioned floor area	conditioned useful floor area	conditioned living area	conditioned building volume	energy reference area	number of apartments	number of complete storeys	type / inclination of the	heating situation in the attic	heating situation in the	neighbour situation / number of	classification of the thermal	code for classification of	code for identifi U-value
Clear up formats and formulas (1) Uses first data row as template for dataset formats and formulas. (2) Erases rows without data input. (3) Adds a number of empty dataset rows for new input			only used for extended	indicator for utilisation	reference area determined m²	conditioned floor area m²	conditioned floor area m²	section of the conditioned m²	section of the conditioned m²	conditioned volume of the m³	mandatory / for transform m²		number of conditioned					standard values in W/(m²K):	standard values in 1/h:
Check: Duplicate datasets in selected range?																				
Check: Entries consistent with in-cell dropdown lists?				Tab.Const.Utilisation										Tab.Const.RoofType	Tab.Const.AtticCond	Tab.Const.CellarCond	Tab.Const.AttNeighb	Tab.Const.ThermalBridging	Tab.Const.Infiltration	Tab.Building.Co
VarChar	Integer	Integer	Integer	VarChar	Real	Real	Real	Real	Real	Real	Real	Real	Real	VarChar	VarChar	VarChar	VarChar	VarChar	VarChar	VarChar
PL.N.TH.07.Gen.ReEx.001	2009	9999	0	SingleFamily	342,0	341,9			308,0	1084,0	290,6	2	2	FR	C	C	B_N1	Medium	Medium	PL.Roof.ReEx.(
RS.N.SFH.03.Gen.ReEx.001	1946	1970	0	SingleFamily	190,0	190,0	145,0		145,0	381,0	145,0	3	3	TR	-	C	B_Alone	High	Medium	RS.Ceiling.ReEx
XX.N.SFH.01.Gen.ReEx.001	0	1945	0	SingleFamily					120,0		132,0	1	1	TR	C	N	B_Alone	Medium	Medium	XX.Roof.ReEx.(
XX.N.SFH.02.Gen.ReEx.001	1946	1975	0	SingleFamily					120,0		132,0	1	1	TR	C	N	B_Alone	Medium	Medium	XX.Roof.ReEx.(
XX.N.SFH.03.Gen.ReEx.001	1976	9999	0	SingleFamily					120,0		132,0	1	1	TR	C	N	B_Alone	Medium	Medium	XX.Roof.ReEx.(
XX.N.MFH.01.Gen.ReEx.001	0	1945	0	Apartment					9090,0		9999,0	100	6	FR	-	N	B_N1	Medium	Medium	XX.Roof.ReEx.(
XX.N.MFH.02.Gen.ReEx.001	1946	1975	0	Apartment					9090,0		9999,0	100	6	FR	-	N	B_N1	Medium	Medium	XX.Roof.ReEx.(
XX.N.MFH.03.Gen.ReEx.001	1976	9999	0	Apartment					9090,0		9999,0	100	6	FR	-	N	B_N1	Medium	Medium	XX.Roof.ReEx.(
SE.Zone3.MFH.01.250SB.ReEx.001	0	1960	0	Apartment	1420,0	1420,0				3500,0	1207,0	14	3	FR	C	C	B_Alone	High	High	SE.Ceiling.ReEx
SE.Zone3.MFH.01.Gen.ReEx.001				Apartment										FR	C	C	B_Alone	High	High	SE.Ceiling.ReEx

➢ Utilisation of the Userform “Assistant”



If the checkbox “Assistant” in the top left corner of the sheet is set "true" you will get more information about the contents of the datafields (those highlighted yellow with vertical grey stripes):

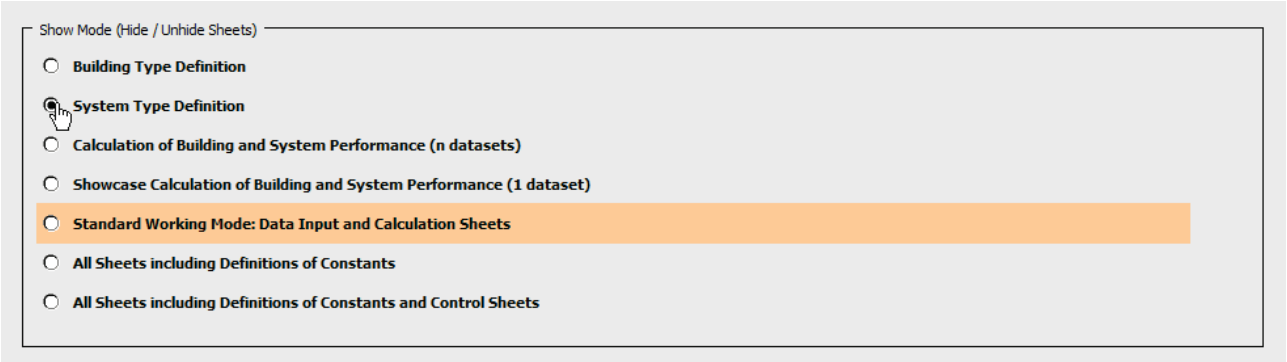




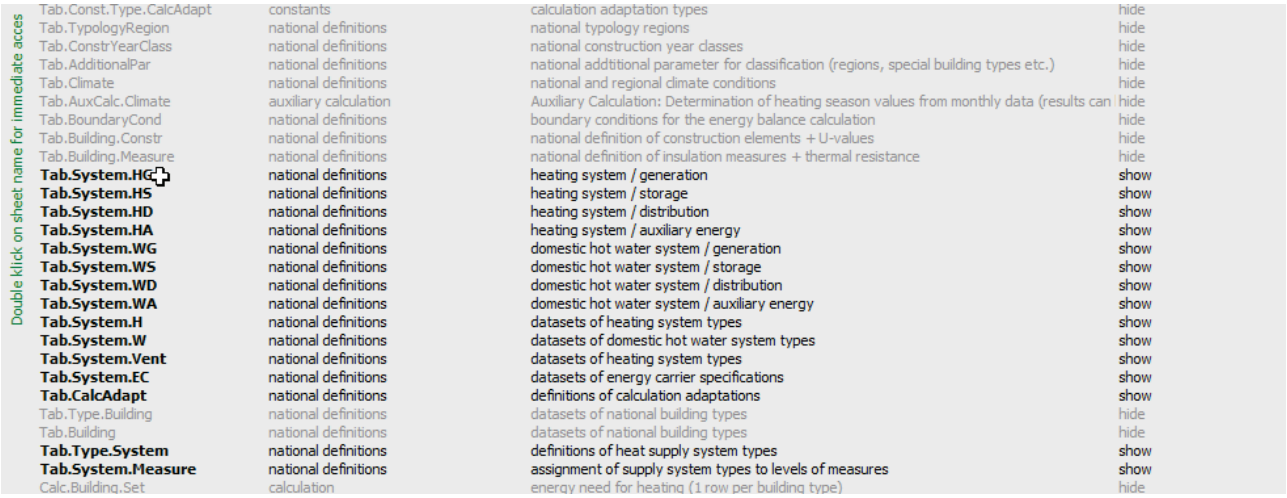
5 Definition of System Types

➢ Sheet “Info”

Select the show mode “System Type Definition”



Now the following sheets will be visible:



Tab.Const.Type.CalcAdapt	constants	calculation adaptation types	hide
Tab.TypologyRegion	national definitions	national typology regions	hide
Tab.ConstrYearClass	national definitions	national construction year classes	hide
Tab.AdditionalPar	national definitions	national addtitional parameter for classification (regions, special building types etc.)	hide
Tab.Climate	national definitions	national and regional climate conditions	hide
Tab.AuxCalc.Climate	auxiliary calculation	Auxiliary Calculation: Determination of heating season values from monthly data (results can	hide
Tab.BoundaryCond	national definitions	boundary conditions for the energy balance calculation	hide
Tab.Building.Constr	national definitions	national definition of construction elements + U-values	hide
Tab.Building.Measure	national definitions	national definition of insulation measures + thermal resistance	hide
Tab.System.HG	national definitions	heating system / generation	show
Tab.System.HS	national definitions	heating system / storage	show
Tab.System.HD	national definitions	heating system / distribution	show
Tab.System.HA	national definitions	heating system / auxiliary energy	show
Tab.System.WG	national definitions	domestic hot water system / generation	show
Tab.System.WS	national definitions	domestic hot water system / storage	show
Tab.System.WD	national definitions	domestic hot water system / distribution	show
Tab.System.WA	national definitions	domestic hot water system / auxiliary energy	show
Tab.System.H	national definitions	datasets of heating system types	show
Tab.System.W	national definitions	datasets of domestic hot water system types	show
Tab.System.Vent	national definitions	datasets of heating system types	show
Tab.System.EC	national definitions	datasets of energy carrier specifications	show
Tab.CalcAdapt	national definitions	definitions of calculation adaptations	show
Tab.Type.Building	national definitions	datasets of national building types	hide
Tab.Building	national definitions	datasets of national building types	hide
Tab.Type.System	national definitions	definitions of heat supply system types	show
Tab.System.Measure	national definitions	assignment of supply system types to levels of measures	show
Calc.Building.Set	calculation	energy need for heating (1 row per building type)	hide

When you double-click on a sheet name you will directly jump to the respective table.

You can now define heat generators, heat storages and distribution systems in a way similar to those of the test country xx.

➢ Sheets “Tab.System.HG”, “Tab.System.HS”, …

Here you define the components (see examples for country xx), at least one per table for a start.

You must decide if the values given for the component are relevant for all buildings (generic: “GEN”), or if they are restricted to small buildings (single-family houses: “SUH”) or larger buildings (multi-family houses “MUH”).

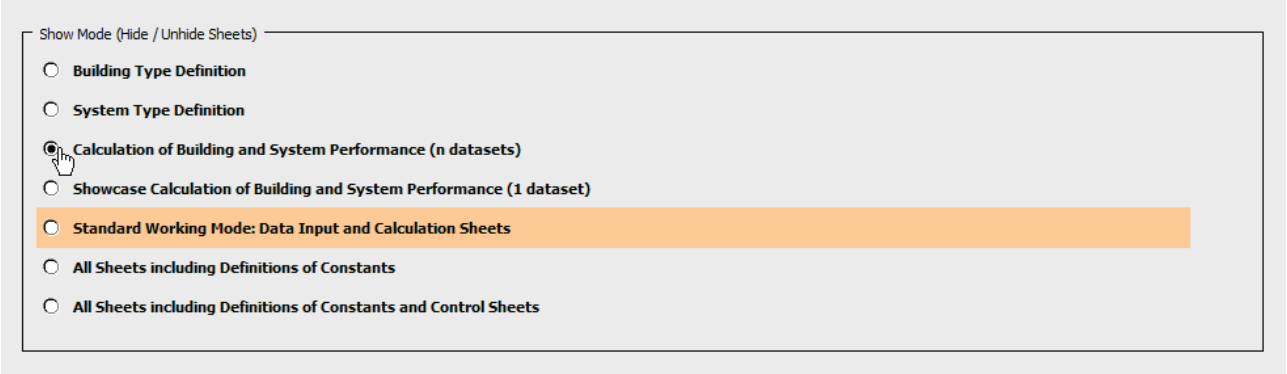
When you will later complete the national typology you will be asked to fill these tables with comprehensive data of typical heating and dhw systems of your country.

➢ Sheets “Tab.System.H” and “Tab.System.W”

These sheets allow for combining the components to heating systems and hot water systems.

6 Calculation of Energy Performance for a Set of Buildings / Systems

Now you can try the common energy performance calculation by selecting the show mode "Calculation of Building and System Performance (n datasets)".



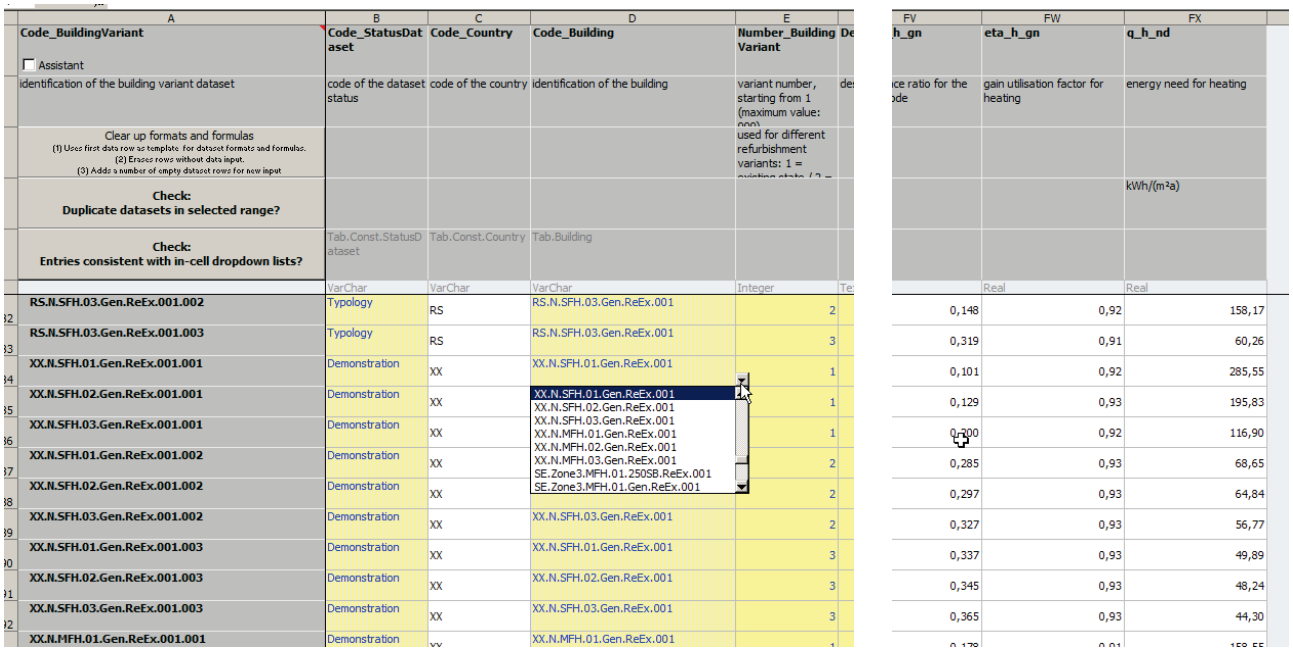
➢ Sheet "Tab.Climate" and "Tab.AuxCalc.Climate"

As a precondition for the energy balance calculation you have to define a national or regional climate. If the data required by "Tab.Climate" are not available you can determine them on the basis of monthly data by use of the auxiliary calculation sheet "AuxCalc.Climate".

A	H	I	J	K	L	M	N
Code_ClimateRegion	**Theta_e_Base**	**HeatingDays**	**Theta_e**	**I_Sol_Hor**	**I_Sol_East**	**I_Sol_South**	**I_Sol_West**
dataset identification	heating base temperature: heat demand is calculated in case that the daily	number of days per year during heating season (average dayly temperature is	average external air temperature during the heating season	average global irradiation on horizontal surface during the heating season	average global irradiation on vertical surface oriented East during the heating	average global irradiation on vertical surface oriented South during the heating	average global irradiation on vertical surface oriented West during the heating
Clear up formats and formulas (1) Uses first data row as template for dataset formats and formulas. (2) Erases rows without data input. (3) Adds a number of empty dataset rows for new input	if values are not available they can be determined from monthly climate data by	if values are not available they can be determined from monthly climate data by	if values are not available they can be determined from monthly climate data by	if values are not available they can be determined from monthly climate data by	if values are not available they can be determined from monthly climate data by	if values are not available they can be determined from monthly climate data by	if values are not available they can be determined from monthly climate data by
	°C	d	°C	kWh/a	kWh/a	kWh/a	kWh/a
Tab.Climate							
VarChar	Real	Real	Real	Real	Real	Real	Real
GR.A	12	57	11,3	139	88	165	88
GR.B	12	104	10,0	244	160	301	160
GR.C	12	150	7,5	351	232	424	232
GR.D	12	168	6,0	420	278	497	278
IE.N	12	243	7,6	475	306	485	306
IT.MidClim	12	174	5,2	378	290	496	290
PL.N	12	242	2,8	647	462	560	448
RS.N	12	185	5,6	398	310	455	310
XX.N	12	200	5,0	500	300	400	300
SE.Zone3	12	261	2,2	450	328	496	328
SE.Zone2	12	286	0,3	492	372	524	372
SE.Zone1	12	365	-1,2	711	628	725	628

➢ Sheet “Calc.Building.Set”

Here you can combine the building types defined in the sheet “Tab.Building” and the refurbishment measures defined in the sheet “Tab.Building.Measure”.

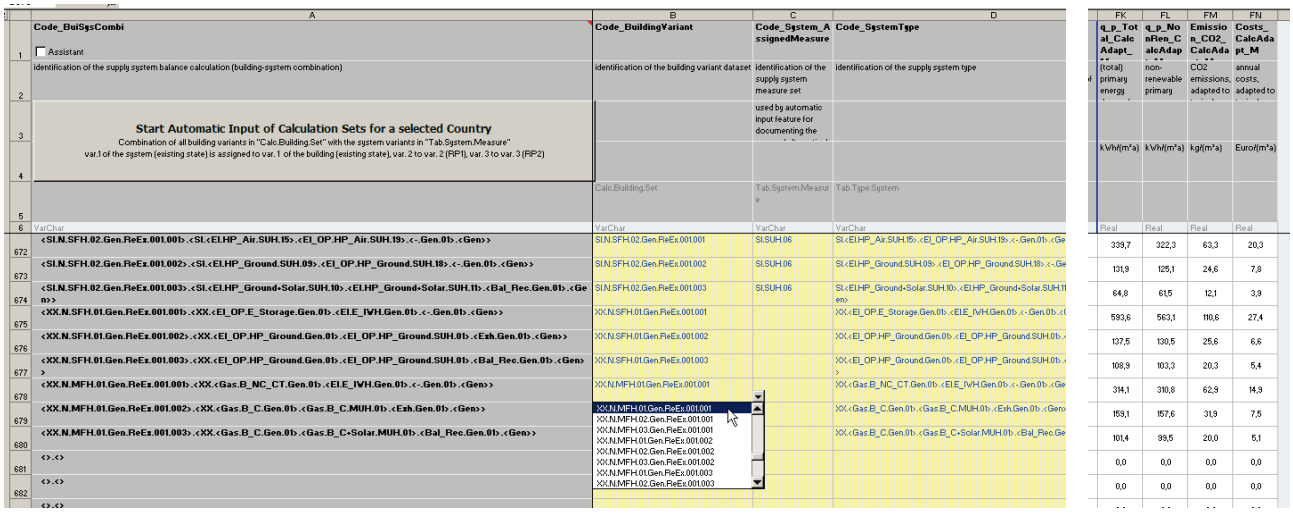


Code_BuildingVariant	Code_StatusDataset	Code_Country	Code_Building	Number_BuildingVariant	h_gn	eta_h_gn	q_h_nd
Assistant							
identification of the building variant dataset	code of the dataset status	code of the country	identification of the building	variant number, starting from 1 (maximum value: 999)	ice ratio for the ode	gain utilisation factor for heating	energy need for heating
Clear up formats and formulas (1) Uses first data row as template for dataset formats and formulas. (2) Erases rows without data input. (3) Adds a number of empty dataset rows for new input				used for different refurbishment variants: 1 = existing state / 2 =			
Check: Duplicate datasets in selected range?							kWh/(m²a)
Check: Entries consistent with in-cell dropdown lists?	Tab.Const.StatusDataset	Tab.Const.Country	Tab.Building				
	VarChar	VarChar	VarChar	Integer		Real	Real
RS.N.SFH.03.Gen.ReEx.001.002	Typology	RS	RS.N.SFH.03.Gen.ReEx.001	2	0,148	0,92	158,17
RS.N.SFH.03.Gen.ReEx.001.003	Typology	RS	RS.N.SFH.03.Gen.ReEx.001	3	0,319	0,91	60,26
XX.N.SFH.01.Gen.ReEx.001.001	Demonstration	XX	XX.N.SFH.01.Gen.ReEx.001	1	0,101	0,92	285,55
XX.N.SFH.02.Gen.ReEx.001.001	Demonstration	XX	XX.N.SFH.01.Gen.ReEx.001	1	0,129	0,93	195,83
XX.N.SFH.03.Gen.ReEx.001.001	Demonstration	XX	XX.N.SFH.02.Gen.ReEx.001	1	0,100	0,92	116,90
XX.N.SFH.01.Gen.ReEx.001.002	Demonstration	XX	XX.N.SFH.03.Gen.ReEx.001	2	0,285	0,93	68,65
XX.N.SFH.02.Gen.ReEx.001.002	Demonstration	XX	XX.N.MFH.01.Gen.ReEx.001	2	0,297	0,93	64,84
XX.N.SFH.03.Gen.ReEx.001.002	Demonstration	XX	XX.N.MFH.02.Gen.ReEx.001	2	0,327	0,93	56,77
XX.N.SFH.01.Gen.ReEx.001.003	Demonstration	XX	XX.N.MFH.03.Gen.ReEx.001	3	0,337	0,93	49,89
XX.N.SFH.02.Gen.ReEx.001.003	Demonstration	XX	SE.Zone3.MFH.01.250SB.ReEx.001	3	0,345	0,93	48,24
XX.N.SFH.03.Gen.ReEx.001.003	Demonstration	XX	SE.Zone3.MFH.01.Gen.ReEx.001	3	0,365	0,93	44,30
XX.N.MFH.01.Gen.ReEx.001.001	Demonstration	XX	XX.N.MFH.01.Gen.ReEx.001	1			

You will find the result, the energy need for heating, in the datafield “q_h_nd”.

➢ Sheet “Calc.System.Set”

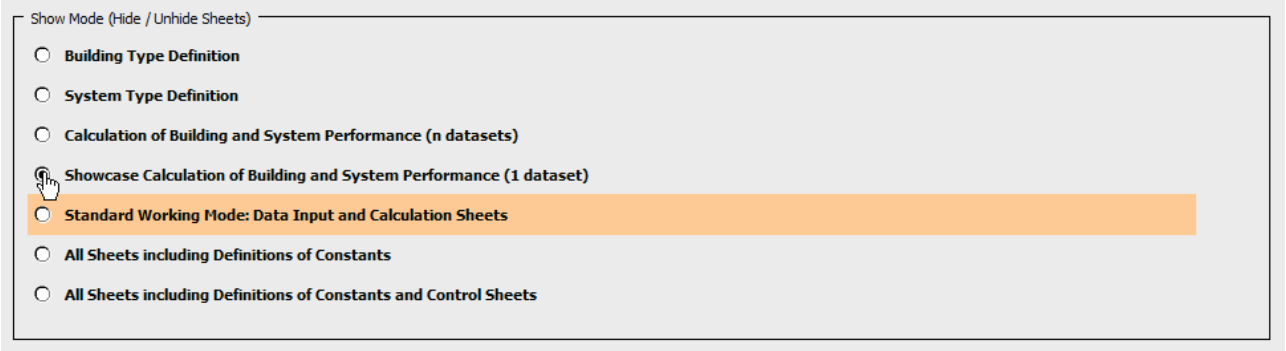
This sheet serves for calculation of the need of different energy carriers for a given building / system combination. The example single-family house was combined with an electrical storage heating system, the refurbishment is calculated with an electrical heat pump system. In the example apartment building the existing gas heating system and decentral electric hot water system are replaced by a new system with condensing boiler for heating and dhw. Variant 3 also includes a thermal solar system and a ventilation system with heat recovery. The screenshot below also shows the calculation results.



Code_BuiSysCombi	Code_BuildingVariant	Code_System_AssignedMeasure	Code_SystemType	q_p_Total_CalcAdapt_	q_p_NonRen_CalcAdapt_	Emission_CO2_CalcAdapt_M	Costs_CalcAdapt_M
Assistant							
identification of the supply system balance calculation (building-system combination)	identification of the building variant dataset	identification of the supply system measure set	identification of the supply system type	(total) primary energy	non-renewable primary	CO2 emissions, adapted to	annual costs, adapted to
Start Automatic Input of Calculation Sets for a selected Country Combination of all building variants in "Calc.Building.Set" with the system variants in "Tab.System.Measure" var.1 of the system (existing state) is assigned to var. 1 of the building (existing state), var. 2 to var. 2 (RP1), var. 3 to var. 3 (RP2)		used by automatic input feature for documenting the					
	Calc.Building.Set	Tab.System.Measure	Tab.Type.System				
	VarChar	VarChar	VarChar	Real	Real	Real	Real
<SI.N.SFH.02.Gen.ReEx.001.001>.<SI.<EI.HP_Air.SUH.15>.<EI_OP.HP_Air.SUH.19>.<-.Gen.01>.<Gen>>	SI.N.SFH.02.Gen.ReEx.001.001	SI.SUH.06	SI.<EI.HP_Air.SUH.15>.<EI_OP.HP_Air.SUH.19>.<-.Gen.01>.<Ge	339,7	322,3	63,3	20,3
<SI.N.SFH.02.Gen.ReEx.001.002>.<SI.<EI.HP_Ground.SUH.09>.<EI_OP.HP_Ground.SUH.18>.<-.Gen.01>.<Gen>>	SI.N.SFH.02.Gen.ReEx.001.002	SI.SUH.06	SI.<EI.HP_Ground.SUH.09>.<EI_OP.HP_Ground.SUH.18>.<-.Ge	131,9	125,1	24,6	7,8
<SI.N.SFH.02.Gen.ReEx.001.003>.<SI.<EI.HP_Ground+Solar.SUH.10>.<EI.HP_Ground+Solar.SUH.11>.<Bal_Rec.Gen.01>.<Gen>>	SI.N.SFH.02.Gen.ReEx.001.003	SI.SUH.06	SI.<EI.HP_Ground+Solar.SUH.10>.<EI.HP_Ground+Solar.SUH.11 en>	64,8	61,5	12,1	3,9
<XX.N.SFH.01.Gen.ReEx.001.001>.<XX.<EI_OP.E_Storage.Gen.01>.<EI.E_IVH.Gen.01>.<-.Gen.01>.<Gen>>	XX.N.SFH.01.Gen.ReEx.001.001		XX.<EI_OP.E_Storage.Gen.01>.<EI.E_IVH.Gen.01>.<-.Gen.01>.<(	593,6	563,1	110,6	27,4
<XX.N.SFH.01.Gen.ReEx.001.002>.<XX.<EI_OP.HP_Ground.Gen.01>.<EI_OP.HP_Ground.SUH.01>.<Exh.Gen.01>.<Gen>>	XX.N.SFH.01.Gen.ReEx.001.002		XX.<EI_OP.HP_Ground.Gen.01>.<EI_OP.HP_Ground.SUH.01>.<	137,5	130,5	25,6	6,6
<XX.N.SFH.01.Gen.ReEx.001.003>.<XX.<EI_OP.HP_Ground.Gen.01>.<EI_OP.HP_Ground.SUH.01>.<Bal_Rec.Gen.01>.<Gen>>	XX.N.SFH.01.Gen.ReEx.001.003		XX.<EI_OP.HP_Ground.Gen.01>.<EI_OP.HP_Ground.SUH.01>.<	108,9	103,3	20,3	5,4
<XX.N.MFH.01.Gen.ReEx.001.001>.<XX.<Gas.B_NC_CT.Gen.01>.<EI.E_IVH.Gen.01>.<-.Gen.01>.<Gen>>	XX.N.MFH.01.Gen.ReEx.001.001		XX.<Gas.B_NC_CT.Gen.01>.<EI.E_IVH.Gen.01>.<-.Gen.01>.<Ge	314,1	310,8	62,9	14,9
<XX.N.MFH.01.Gen.ReEx.001.002>.<XX.<Gas.B_C.Gen.01>.<Gas.B_C.MUH.01>.<Exh.Gen.01>.<Gen>>	XX.N.MFH.01.Gen.ReEx.001.001		XX.<Gas.B_C.Gen.01>.<Gas.B_C.MUH.01>.<Exh.Gen.01>.<Gen>	159,1	157,6	31,9	7,5
<XX.N.MFH.01.Gen.ReEx.001.003>.<XX.<Gas.B_C.Gen.01>.<Gas.B_C+Solar.MUH.01>.<Bal_Rec.Gen.01>.<Gen>>	XX.N.MFH.02.Gen.ReEx.001.001 XX.N.MFH.03.Gen.ReEx.001.001 XX.N.MFH.01.Gen.ReEx.001.002 XX.N.MFH.02.Gen.ReEx.001.002 XX.N.MFH.03.Gen.ReEx.001.002 XX.N.MFH.01.Gen.ReEx.001.003 XX.N.MFH.02.Gen.ReEx.001.003		XX.<Gas.B_C.Gen.01>.<Gas.B_C+Solar.MUH.01>.<Bal_Rec.Ge	101,4	99,5	20,0	5,1
<>.<>				0,0	0,0	0,0	0,0
<>.<>				0,0	0,0	0,0	0,0
<>.<>							

7 Calculation of Building and System Performance / Details of the Common Procedure

The details of the common calculation procedure can be visualised by changing to the show mode “Showcase Calculation of Building and System Performance (1 dataset)”:



In the following you find the calculation sheets for the example apartment building with applied insulation measures:

➢ Sheet “Calc.Demo.Refurbish”

Thermal Insulation Measures — U-values

building — code: XX.N.MFH.03.Gen.ReEx.001

		Roof 1	Roof 2	Wall 1	Wall 2	Wall 3	Floor 1	Floor 2	Window 1	Window 2	Door 1	
envelope area	$A_{env,i}$	0	501	6949	0	0	485	270	1947	0	2	m²
Construction Element												
code			XX.Roof.ReEx.03.01	XX.Wall.ReEx.03.01			XX.Floor.ReEx.03.01	XX.Floor.ReEx.03.01	XX.Window.ReEx.02.01		XX.Door.ReEx.01.01	
U-value original state	$U_{original,i}$		0,30	0,50			0,70	0,70	2,50		3,50	W/(m²K)
included insulation thickness	$d_{insulation,i}$		0,0	0,0			0,0	0,0				cm
border type		Ext	Unh	Ext	Ext	Ext	Cellar	Cellar				
additional thermal resistance	$R_{add,i}$		0,30	0,00			0,30	0,30				m²K/W
Refurbishment Measure												
code												
thermal resistance of refurbishment measure	$R_{measure,i}$		0,00	0,00			0,00	0,00	0,00		0,00	m²K/W
Result												
type of refurbishment												
thermal resistance before measures	$R_{before,i}$		3,63	2,00			1,73	1,73	0,40		0,29	m²K/W
	$R_{actual,i}$		3,63	2,00			1,73	1,73	0,40		0,29	m²K/W
	$U_{actual,i}$		0,28	0,50			0,58	0,58	2,50		3,50	W/(m²K)

➢ Sheet “Calc.Demo.Building”

Energy Balance Calculation — **Building Performance**

Standard Reference Calculation - based on: EN ISO 13790 / seasonal method

building	XX.N.MFH.03.Gen.ReEx.001 (1976...9999)	reference area	$A_{C,ref}$ 9999,0 m²
climate	XX.N (Demonstration Country)	(conditioned floor area)	

code construction element	original U-value $U_{original,i}$ W/(m²K)	measure type	applied refurbishment measure	actual U-value $U_{actual,i}$ W/(m²K)		area (basis: external dimensions) $A_{env,i}$ m²		adjustment factor soil $b_{tr,i}$		$H_{tr,i}$ W/K	annual heat loss related to $A_{C,Ref}$ kWh/(m²a)
Roof 1					x		x		=		*0,0*
Roof 2	0,30			0,28	x	501,2	x	1,00	=	137,9	*0,9*
Wall 1	0,50			0,50	x	6949,1	x	1,00	=	3474,6	*23,8*
Wall 2					x		x		=		*0,0*
Wall 3					x		x		=		*0,0*
Floor 1	0,70			0,58	x	485,4	x	0,50	=	140,4	*1,0*
Floor 2	0,70			0,58	x	269,5	x	0,50	=	78,0	*0,5*
Window 1	2,50			2,50	x	1947,2	x	1,00	=	4868,0	*33,3*
Window 2					x		x		=		*0,0*
Door 1	3,50			3,50	x	2,0	x	1,00	=	7,0	*0,0*
				ΔU_{tb}		$\Sigma A_{env,i}$				$H_{tr,tb}$	
thermal bridging: surcharge on the U-values				0,10	×	10154,4	×	1,00	=	1015,4	*6,9*

Heat transfer coefficient by transmission H_{tr} sum **9721** — ***66,5***

Heat transfer coefficient by ventilation H_{ve}

volume-specific heat capacity air $c_{p,air}$ Wh/(m³K)		air change rate by use $n_{air,use}$ 1/h		by infiltration $n_{air,infiltration}$ 1/h	$A_{C,ref}$ m²	room height (standard value) h_{room} m	H_{ve} W/K	
0,34	x (	0,40	+	0,10	) × 9999,0	× 2,50	=	**4250**

29,1

accumulated differences between internal and external temperature

internal temp. ϑ_i °C		external temp. ϑ_e °C		heating days d_{hs} d/a		Kd/a
(20,0	−	5,0	) ×	200	=	3000

Total heat transfer Q_{ht}

H_{tr} W/K		H_{ve} W/K		temperature reduction factor F_{red} (h_{tr}= 0,97 W/(m²K))		x 0,024 kKh/a	kWh/a
(9721	+	4250	) ×	0,95	×	72,0	= **955607**

95,6

window orientation	reduction factors: external shading F_{sh}		frame area fraction F_F		non-perpendicular F_W	solar energy transmittance $g_{gl,n}$		window area $A_{window,i}$ m²		solar global radiation $I_{sol,i}$ kWh/(m²a)		kWh/a	
1. Horizontal	0,80	× (1 -	0,30	) ×	0,90	× 0,70	×		×	500	=		*0,0*
2. East	0,60	× (1 -	0,30	) ×	0,90	× 0,70	×	493,8	×	300	=	39198	*3,9*
3. South	0,60	× (1 -	0,30	) ×	0,90	× 0,70	×	610,1	×	400	=	64573	*6,5*
4. West	0,60	× (1 -	0,30	) ×	0,90	× 0,70	×	493,8	×	300	=	39198	*3,9*
5. North	0,60	× (1 -	0,30	) ×	0,90	× 0,70	×	349,5	×	180	=	16646	*1,7*

Solar heat load during heating season Q_{sol} sum **159614** — ***16,0***

Internal heat sources Q_{int}

kh/d		internal heat sources φ_i W/m²		heating days d_{hs} d/a		$A_{C,ref}$ m²	kWh/a	
0,024	×	3,00	×	200	×	9999,0	=	**143986**

14,4

internal heat capacity per m² $A_{C,ref}$ c_m 45 Wh/(m²K)

time constant of the building $\tau = \frac{c_m \cdot A_{C,ref}}{H_{tr} + H_{ve}}$ = 32 h

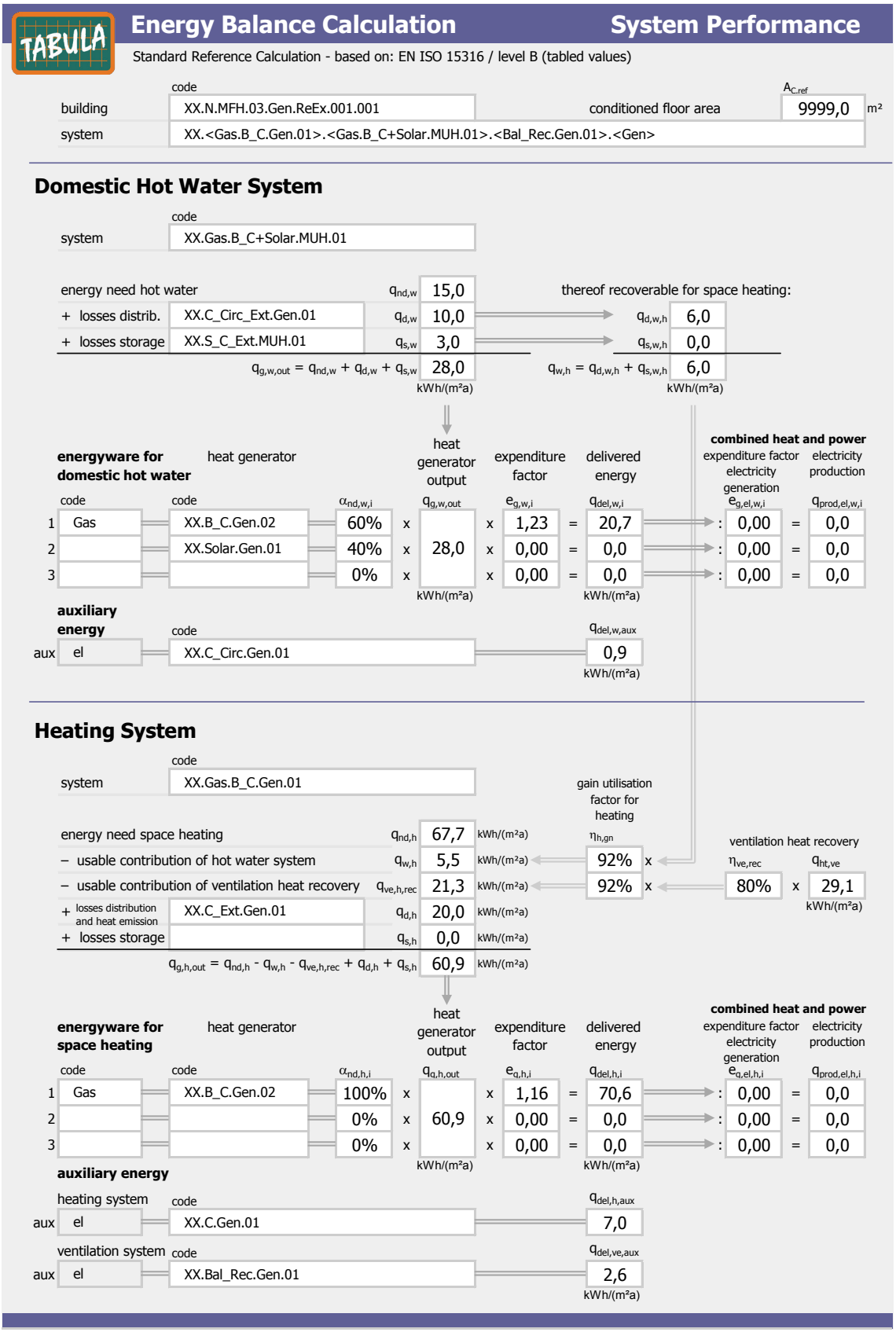
parameter $a_H = a_{H,0} + \frac{\tau}{\tau_{H,0}}$ = 1,87

heat balance ratio for the heating mode $\gamma_{h,gn} = \frac{Q_{sol}+Q_{int}}{Q_{ht}}$ = 0,318

gain utilisation factor for heating $\eta_{h,gn} = \frac{1-\gamma^{a_H}}{1-\gamma^{a_H+1}}$ = 0,92

Energy need for heating $Q_{H,nd}$ $Q_{ht} - \eta_{h,gn} \times (Q_{sol} + Q_{int})$ = **677108** kWh/a — ***67,7***

➢ Sheet “Calc.Demo.System”



Energy Balance Calculation — **System Performance**

Standard Reference Calculation - based on: EN ISO 15316 / level B (tabled values)

	code		$A_{C,ref}$	
building	XX.N.MFH.03.Gen.ReEx.001.001	conditioned floor area	9999,0	m²
system	XX.<Gas.B_C.Gen.01>.<Gas.B_C+Solar.MUH.01>.<Bal_Rec.Gen.01>.<Gen>			

Domestic Hot Water System

system: XX.Gas.B_C+Solar.MUH.01

				thereof recoverable for space heating:	
energy need hot water		$q_{nd,w}$	15,0		
+ losses distrib.	XX.C_Circ_Ext.Gen.01	$q_{d,w}$	10,0	$q_{d,w,h}$	6,0
+ losses storage	XX.S_C_Ext.MUH.01	$q_{s,w}$	3,0	$q_{s,w,h}$	0,0
	$q_{g,w,out} = q_{nd,w} + q_{d,w} + q_{s,w}$		28,0 kWh/(m²a)	$q_{w,h} = q_{d,w,h} + q_{s,w,h}$	6,0 kWh/(m²a)

energyware for domestic hot water	code	heat generator	code	$\alpha_{nd,w,i}$	$q_{g,w,out}$ heat generator output	$e_{g,w,i}$ expenditure factor	$q_{del,w,i}$ delivered energy	combined heat and power: expenditure factor electricity generation $e_{g,el,w,i}$	combined heat and power: electricity production $q_{prod,el,w,i}$
1	Gas	XX.B_C.Gen.02		60%	28,0 kWh/(m²a)	1,23	20,7 kWh/(m²a)	0,00	0,0
2		XX.Solar.Gen.01		40%		0,00	0,0	0,00	0,0
3				0%		0,00	0,0	0,00	0,0

auxiliary energy	code		$q_{del,w,aux}$
aux el	XX.C_Circ.Gen.01		0,9 kWh/(m²a)

Heating System

system: XX.Gas.B_C.Gen.01

			gain utilisation factor for heating $\eta_{h,gn}$	ventilation heat recovery: $\eta_{ve,rec}$	ventilation heat recovery: $q_{ht,ve}$
energy need space heating		$q_{nd,h}$ 67,7 kWh/(m²a)			
– usable contribution of hot water system		$q_{w,h}$ 5,5 kWh/(m²a)	92%		
– usable contribution of ventilation heat recovery		$q_{ve,h,rec}$ 21,3 kWh/(m²a)	92%	80%	29,1 kWh/(m²a)
+ losses distribution and heat emission	XX.C_Ext.Gen.01	$q_{d,h}$ 20,0 kWh/(m²a)			
+ losses storage		$q_{s,h}$ 0,0 kWh/(m²a)			
	$q_{g,h,out} = q_{nd,h} - q_{w,h} - q_{ve,h,rec} + q_{d,h} + q_{s,h}$	60,9 kWh/(m²a)			

energyware for space heating	code	heat generator	code	$\alpha_{nd,h,i}$	$q_{q,h,out}$ heat generator output	$e_{q,h,i}$ expenditure factor	$q_{del,h,i}$ delivered energy	combined heat and power: expenditure factor electricity generation $e_{q,el,h,i}$	combined heat and power: electricity production $q_{prod,el,h,i}$
1	Gas	XX.B_C.Gen.02		100%	60,9 kWh/(m²a)	1,16	70,6 kWh/(m²a)	0,00	0,0
2				0%		0,00	0,0	0,00	0,0
3				0%		0,00	0,0	0,00	0,0

auxiliary energy		code		$q_{del,h,aux}$
heating system	aux el	XX.C.Gen.01		7,0
ventilation system	aux el	XX.Bal_Rec.Gen.01		2,6 kWh/(m²a)

Energy Balance Calculation — Energy Carriers

	code		$A_{C,ref}$	
building	XX.N.MFH.03.Gen.ReEx.001.001	conditioned floor area	9999,0	m²
system	XX.<Gas.B_C.Gen.01>.<Gas.B_C+Solar.MUH.01>.<Bal_Rec.Gen.01>.<Gen>			

Assessment of Energywares

version of energy carrier specification — code: Gen

Standard Calculation

	delivered energy	total primary energy		non-renewable primary energy		carbon dioxide emissions		energy costs	
Heating (+ Ventilation) System	$q_{del,i}$	$f_{p,total,i}$	$q_{p,total,i} = q_{del,i} \cdot f_{p,total,i}$	$f_{p,nonren,i}$	$q_{p,nonren,i} = q_{del,i} \cdot f_{p,nonren,i}$	$f_{CO2,i}$	$m_{CO2,i} = q_{del,i} \cdot f_{CO2,i}$	p_i (energyware price)	$c_i = q_{del,i} \cdot p_i$
Gas	70,6	1,36	96,0	1,36	96,0	277	19,6	6,0	4,24
	0,0	0,00	0,0	0,00	0,0	0	0,0	0,0	0,00
	0,0	0,00	0,0	0,00	0,0	0	0,0	0,0	0,00
Auxiliary Electricity	9,6	3,31	31,8	3,14	30,1	617	5,9	15,0	1,44
Electricity Production / Export	0,0	1,30	0,0	1,30	0,0	420	0,0	8,0	0,00
Domestic Hot Water System									
Gas	20,7	1,36	28,1	1,36	28,1	277	5,7	6,0	1,24
	0,0	0,00	0,0	0,00	0,0	0	0,0	0,0	0,00
	0,0	0,00	0,0	0,00	0,0	0	0,0	0,0	0,00
Auxiliary Electricity	0,9	3,31	3,0	3,14	2,8	617	0,6	15,0	0,14
Electricity Production / Export	0,0	1,30	0,0	1,30	0,0	420	0,0	8,0	0,00
	kWh/(m²a)								
Summary and Expenditure Factors	heat need q_{nd}	Σq_{del}	$e_{p,total} = \frac{q_{p,total}}{q_{nd}}$	$q_{p,total} = \Sigma q_{p,total}$	$e_{p,nonren} = \frac{q_{p,nonren}}{q_{nd}}$	$q_{p,nonren} = \Sigma q_{p,nonren,i}$	$f_{CO2,heat} = \frac{m_{CO2}}{q_{nd}}$	$m_{CO2,i} = \Sigma m_{CO2,i}$	$p_{heat} = \frac{c}{q_{nd}}$	$c = \Sigma c_i$
heating (+ ventilation) system	67,7	80,2	1,89	127,8	1,86	126,2	376	25,5	8,4	5,68
domestic hot water system	15,0	21,6	2,07	31,1	2,06	30,9	419	6,3	9,2	1,37
total	82,7	101,8	1,92	158,9	1,90	157,1	384	31,8	8,5	7,05
	kWh/(m²a)	kWh/(m²a)		kWh/(m²a)		kWh/(m²a)	g/kWh	kg/(m²a)	Cent/kWh	Euro/(m²a)

Typical Values of the Measured Consumption - Empirical Calibration

code: XX.M.01

The empirical calibration factor describes a typical ratio of the energy uses determined by measurements for a large number of buildings and by the TABULA method for the given value of the TABULA method.

application field	central heating systems: fuels and district heating
determination method	demonstration values
accuracy level	A = determined for the whole building stock or a representative sample

	empirical relation						current value
delivered energy (without auxiliary electricity) according to standard calculation method	0	100	200	300	400	500	91,3
adaptation factor	1,10	1,00	0,80	0,70	0,60	0,50	1 1,01

		Standard Calculation			Typical Measured Consumption		
Summary (including subcategories)		heating	dhw	sum	heating	dhw	sum
Gas	$q_{del,\Sigma gas}$	70,6	20,7	**91,3**	71,2	20,8	**92,1**
Oil	$q_{del,\Sigma oil}$	0,0	0,0	**0,0**	0,0	0,0	**0,0**
Coal	$q_{del,\Sigma coal}$	0,0	0,0	**0,0**	0,0	0,0	**0,0**
Bio	$q_{del,\Sigma bio}$	0,0	0,0	**0,0**	0,0	0,0	**0,0**
El	$q_{del,\Sigma el}$	0,0	0,0	**0,0**	0,0	0,0	**0,0**
DH	$q_{del,\Sigma dh}$	0,0	0,0	**0,0**	0,0	0,0	**0,0**
Other	$q_{del,\Sigma other}$	0,0	0,0	**0,0**	0,0	0,0	**0,0**
Auxiliary Electricity	$q_{del,\Sigma aux}$	9,6	0,9	**10,5**	9,7	0,9	**10,6**
Produced / Exported Electricity	$q_{exp,\Sigma el}$	0,0	0,0	**0,0**	0,0	0,0	**0,0**