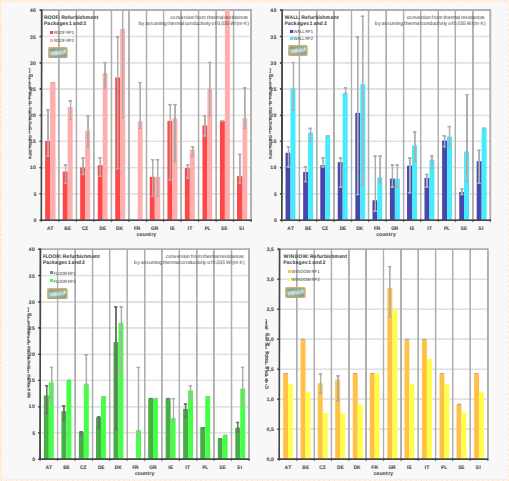
Typology Approach for Building Stock Energy Assessment

Evaluation of the TABULA Database

Comparison of Typical Buildings and Heat Supply Systems from 12 European Countries



– TABULA Work Report –

TABULA Project Team

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Contents

1 Intention of the Analyses

During the TABULA project the partners from 13 countries provided data of example buildings and systems for showcase calculations representing different national building and system types. The following data tables were used to collect this information:

Table 1: Analysed data sheets of the Excel workbook TABULA.xls

Sheet	Content
Tab.Building.Constr	national definition of construction elements + U-values
Tab.Building.Measure	national definition of insulation measures + thermal resistance
Tab.System.HG	heating system / generation
Tab.System.HS	heating system / storage
Tab.System.HD	heating system / distribution
Tab.System.HA	heating system / auxiliary energy
Tab.System.WG	domestic hot water system / generation
Tab.System.WS	domestic hot water system / storage
Tab.System.WD	domestic hot water system / distribution
Tab.System.WA	domestic hot water system / auxiliary energy
Tab.System.H	datasets of heating system types
Tab.System.W	datasets of domestic hot water system types
Tab.System.Vent	datasets of heating system types
Tab.System.EC	datasets of energy carrier specifications
Tab.Building	datasets of national building types
Calc.Building.Set	definition of variants and calculation of the energy need for heating
Calc.System.Set	definition of variants and calculation of the system efficiency

These sheets are part of the workbook TABULA.xls which was used as a database and programming template for the TABULA WebTool.[1]

After the collection of these data an evaluation was performed which is documented in this report. At the time of the analysis the TABULA database comprised data from 12 countries: 429 datasets of real buildings and 1203 datasets of heat supply components.

The intention of the evaluation was:

- **Make a comparison of energy related features of typical buildings from different countries:**
  Show characteristics of the envelope areas, the thermal performance of construction elements, the typical and advanced insulation measures, the supply system efficiency. What is common? What is different?
- **Generate default values for rough estimations on supranational level:**
  In some cases components differ only slightly from country to country. Here the determination of averages seems an appropriate approach to deliver "common" values. These numbers can be used as default values in the case that national values have not (yet) been determined. In the future this might be helpful especially for experts of countries which did not participate at the TABULA project. Also simplified supranational considerations could rely on the default values.

[1] Information about the workbook: http://www.building-typology.eu/tabulapublications.html / acess to the webtool: http://webtool.building-typology.eu/

- **Contribute to a high data quality:**
  Data acquisition and transformation is prone to errors. Especially the determination of the thermal envelope area and the conditioned floor area of a building is problematic: Double counting or omission of areas, copy-paste errors, uncertainties as regards the correct position of the thermal envelope (e.g. in case of unheated spaces). The definition of key figures and the determination of their typical ranges and dependence of the main geometrical parameters may help in the future to flag implausible datasets. The knowledge about typical area relations may not only help to improve the data quality of the TABULA example building database but can also be useful in national EPC issuing.

2 Thermal Envelope Area

2.1 Analysed Quantities

The analyses of the thermal envelope areas of the example buildings are based on the following quantities (Sheet "Tab.Building"):

Table 2: Input quantities (TABULA datafields)

A_C_Ref	energy reference area (conditioned floor area, internal dimensions)	mandatory / for transformation from other area types see DATAMINE evaluation		m²
n_Storey	number of complete storeys	number of conditioned floors/storeys of the building (without attic storey, without cellar) (see below) If there is a completely conditioned underground storey it is not considered here (In this case there is a completely conditioned cellar, so cellar_cond=c, see below).		
Code_RoofType	type / inclination of the roof	TR FR UC	tilted roof, tilted >= 30° flat roof, tilted < 30° upper floor ceiling below unheated attic space	
Code_AtticCond	heating situation in the attic rooms (if available)	- C P N	not existent completely conditioned partly conditioned not conditioned	
Code_CellarCond	heating situation in the cellar rooms (if available)	- C P N	not existent completely conditioned partly conditioned not conditioned	
Code_AttachedNeighbours	neighbour situation / number of directly attached buildings	B_Alone B_N1 B_N2	stand-alone building (detached) 1 neighbour (semi-detached) 2 neighbours (terraced)	
A_Roof_1	surface area (external dimensions)	element type roof 1		m²
A_Roof_2	surface area (external dimensions)	element type roof 2		m²
A_Wall_1	surface area (external dimensions)	element type wall 1		m²
A_Wall_2	surface area (external dimensions)	element type wall 2		m²
A_Wall_3	surface area (external dimensions)	element type wall 3		m²
A_Floor_1	surface area (external dimensions)	element type floor 1		m²
A_Floor_2	surface area (external dimensions)	element type floor 2		m²
A_Window_1	surface area, including frame	element type window 1		m²
A_Window_2	surface area, including frame	element type window 2		m²
A_Door_1	surface area, including frame	element type door 1		m²

During the analyses the following auxiliary quantities are used:

Table 3: Auxiliary quantities

f_AtticCond / f_CellarCond	heated fraction of the available space	values for cases of Code_AtticCond / Code_CellarCond: "-": 0 "C": 1 "P": 0,5 "N": 0	
n_Storey_eff	effective number of storeys including conditioned areas in cellar and attic	= n_storey + f_CellarCond + 0,75 * f_attic_cond	
A_C_Storey	conditioned floor area per storey	= A_C_Ref / n_Storey_eff	m²
A_Roof	A_Roof_1 + A_Roof_2		m²
A_Wall	A_Wall_1 + A_Wall_2 + A_Wall_3		m²
A_Window	A_Window_1 + A_Window_2 + A_Door_1		m²
A_Floor	A_Floor_1 + A_Floor_2		m²

2.2 Floor Area Related Averages

The following table shows the conditioned floor areas and the thermal envelope areas of the example buildings from the different countries, averaged over all construction year classes and differentiated by building size class.

In addition the envelope areas per conditioned floor area were calculated for each envelope type. These indicators can be useful for a first quality assurance since they are usually positioned in a certain range. Apart from that, they also can serve as a preliminary basis for the definition of synthetical average buildings for the energy assessment of building stocks (as far as no deeper empirical investigation of the building stock is available).[2]

[2] see: TABULA Thematic Report N° 2
http://www.building-typology.eu/downloads/public/docs/report/TABULA_TR2_D8_NationalEnergyBalances.pdf

Table 4: Average thermal envelope areas of the example buildings per country and building size class and derived floor area related values

	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	RS	SE	SI	Common	
SFH (single family houses)															
A_C_Ref	173	214	107	177	124	118	167	121	154	136	145	121	233	153	m²
average thermal envelope area															
A_Roof	159	159	79	128	132	95	120	103	98	88	75	142	109	114	m²
A_Window	31	46	22	31	23	13	36	22	19	29	26	25	35	27	m²
A_Wall	226	209	144	167	122	103	233	131	226	113	184	200	173	172	m²
A_Floor	113	136	64	97	123	91	104	102	89	79	74	142	112	102	m²
average thermal envelope area related to the conditioned floor area															
A_Roof / A_C_Ref	0,97	0,75	0,78	0,74	1,06	0,81	0,82	0,88	0,64	0,66	0,52	1,18	0,59	0,80	m²/m²
A_Window / A_C_Ref	0,18	0,22	0,20	0,18	0,19	0,12	0,22	0,18	0,13	0,21	0,18	0,21	0,16	0,18	m²/m²
A_Wall / A_C_Ref	1,33	0,98	1,38	0,98	0,98	0,88	1,42	1,09	1,51	0,87	1,27	1,68	0,78	1,17	m²/m²
A_Floor / A_C_Ref	0,69	0,64	0,64	0,57	0,99	0,79	0,70	0,87	0,57	0,59	0,51	1,18	0,58	0,72	m²/m²
TH (terraced houses)															
A_C_Ref	193	175	101	124	111	108	-	97	114	285	-	-	178	149	m²
average thermal envelope area															
A_Roof	135	95	68	70	99	87	-	60	73	201	-	-	116	100	m²
A_Window	31	32	13	25	21	10	-	18	14	59	-	-	30	25	m²
A_Wall	291	121	59	75	82	37	-	83	96	242	-	-	126	121	m²
A_Floor	123	82	65	61	89	86	-	59	68	169	-	-	113	92	m²
average thermal envelope area related to the conditioned floor area															
A_Roof / A_C_Ref	0,75	0,54	0,69	0,57	0,88	0,80	-	0,62	0,64	0,71	-	-	0,69	0,69	m²/m²
A_Window / A_C_Ref	0,17	0,18	0,13	0,19	0,19	0,09	-	0,18	0,13	0,21	-	-	0,16	0,16	m²/m²
A_Wall / A_C_Ref	1,57	0,69	0,59	0,59	0,70	0,35	-	0,85	0,83	0,86	-	-	0,70	0,77	m²/m²
A_Floor / A_C_Ref	0,62	0,47	0,65	0,50	0,78	0,79	-	0,61	0,59	0,60	-	-	0,67	0,63	m²/m²
MFH (multi-family houses)															
A_C_Ref	422	960	639	911	-	2072	946	-	884	2186	-	1207	1258	1148	m²
average thermal envelope area															
A_Roof	212	280	251	327	-	304	254	-	357	602	-	470	281	334	m²
A_Window	61	410	90	154	-	572	248	-	116	469	-	180	179	248	m²
A_Wall	400	440	481	679	-	928	751	-	996	1509	-	800	772	768	m²
A_Floor	206	270	234	310	-	288	246	-	357	602	-	470	350	333	m²
average thermal envelope area related to the conditioned floor area															
A_Roof / A_C_Ref	0,49	0,43	0,47	0,40	-	0,16	0,29	-	0,41	0,29	-	0,39	0,24	0,36	m²/m²
A_Window / A_C_Ref	0,15	0,51	0,15	0,18	-	0,27	0,26	-	0,13	0,22	-	0,15	0,17	0,22	m²/m²
A_Wall / A_C_Ref	1,03	0,60	0,93	0,75	-	0,52	0,85	-	1,15	0,74	-	0,66	0,76	0,78	m²/m²
A_Floor / A_C_Ref	0,49	0,42	0,43	0,36	-	0,15	0,29	-	0,41	0,29	-	0,39	0,34	0,36	m²/m²
AB (apartment blocks)															
A_C_Ref	971	12392	3412	6055	1200	3573	-	1064	2201	6384	-	-	6042	4329	m²
average thermal envelope area															
A_Roof	353	735	458	566	415	547	-	367	490	780	-	-	1023	573	m²
A_Window	170	5074	732	924	272	850	-	179	326	1614	-	-	1154	1130	m²
A_Wall	787	4168	1646	4268	590	1218	-	761	2354	3756	-	-	2618	2217	m²
A_Floor	341	1148	458	591	405	516	-	342	473	674	-	-	863	581	m²
average thermal envelope area related to the conditioned floor area															
A_Roof / A_C_Ref	0,37	0,10	0,19	0,17	0,40	0,16	-	0,34	0,23	0,12	-	-	0,14	0,22	m²/m²
A_Window / A_C_Ref	0,18	0,44	0,20	0,17	0,22	0,24	-	0,17	0,15	0,25	-	-	0,21	0,22	m²/m²
A_Wall / A_C_Ref	0,82	0,36	0,58	0,70	0,57	0,39	-	0,70	1,07	0,62	-	-	0,56	0,64	m²/m²
A_Floor / A_C_Ref	0,36	0,23	0,19	0,16	0,38	0,15	-	0,32	0,22	0,10	-	-	0,13	0,22	m²/m²

2.3 Dependence on the Basic Geometrical Parameters

In the following an analysis of the correlation of the thermal envelope areas with the main geometrical parameters has been performed. The idea is to derive a procedure for the estimation of the thermal envelope area on the basis of the main factors as conditioned floor area, number of storeys, number of neighbours and heating situation of attic and cellar (which could be useful for plausibility checks during data intake and also for the rough energy assessment of large housing portfolios).

The general assumption is a linear dependency of

- window and façade areas on the conditioned floor area of the whole building;
- floor and roof areas on the conditioned floor area of a (complete) storey.

In case of conditioned cellar or attic areas the number of complete storeys has been supplemented by a fraction representing the heated area in these spaces:

- supplement of 1.0 for a completely and 0.5 for a partly conditioned cellar.
- supplement of 0.75 for a completely and 0.5*0.75=0.375 partly conditioned attic.

A one-storey single-family house with a completely heated attic would for example be considered as a building with 1.75 effective storeys.

The "reference area per effective storey" used in the charts below is the TABULA reference floor area $A_{C,ref}$ divided by the number of effective storeys, as defined above.

In order to exclude very implausible values from the analyses the criteria listed in Table 5 were applied. They are based on geometrical considerations: For example the area of a flat roof (based on external dimensions)[3] must be larger than the conditioned floor area of a storey (based on internal dimensions)[3]. By considering a minimum fraction of about 10% for the wall footprint the lower limit would be 1,1.

Table 5: Criteria for plausible area relations

	Minimum		Maximum
A_Wall / A_C_Ref	> 0,2		< 4
A_Window / A_C_Ref	> 0,05		< 0,5
A_Facade / A_C_Ref	> 0,2		< 5
	flat roof or attic not conditioned	attic partly or fully conditioned	
A_Roof / A_C_Storey	> 1,1	> 1,2	< 4
A_Floor / A_C_Storey	> 1,1	> 1,0	< 2

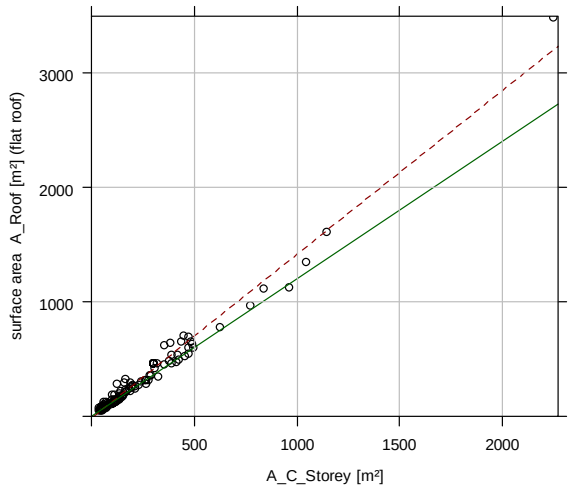
The linear regression analysis was performed by applying the software "R". In Appendix A a documentation of the detailed analyses can be found. The following charts show the main results:

[3] according to the TABULA conventions

Figure 1: Results of the regression analysis for the envelope type roof / upper ceiling

Roof
flat roof

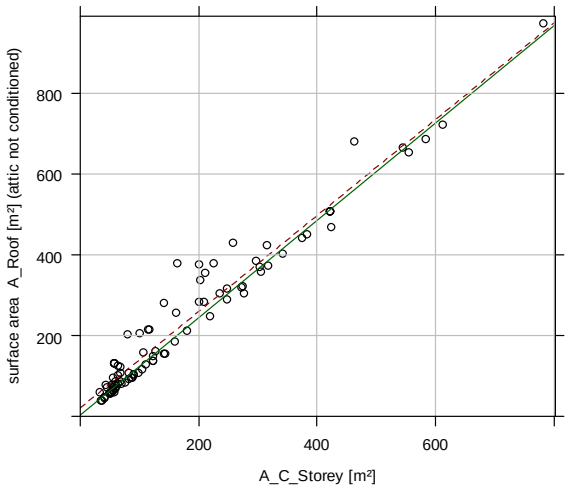
surface area A_Roof [m²] (flat roof) ~ A_C_Storey [m²] (n=153)
regression line (dashed): b = -15., m = 1.43, R² = 0.97



simplified parameters (solid line): b = 5, m = 1.2, R² = 0.94

Roof
attic not conditioned

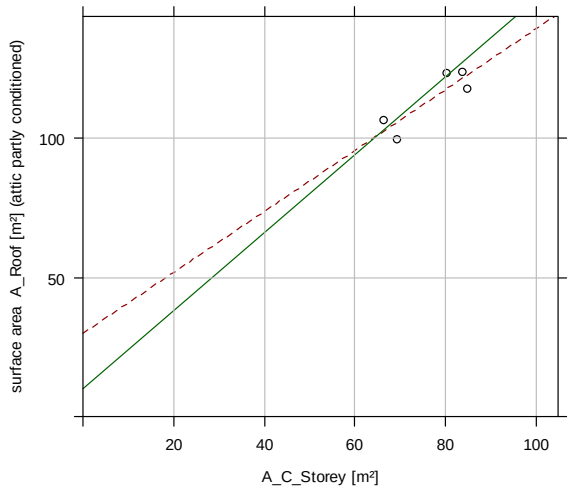
surface area A_Roof [m²] (attic not conditioned) ~ A_C_Storey [m²] (n=94)
regression line (dashed): b = 23.4, m = 1.18, R² = 0.95



simplified parameters (solid line): b = 5, m = 1.2, R² = 0.95

Roof
attic partly conditioned

surface area A_Roof [m²] (attic partly conditioned) ~ A_C_Storey [m²] (n=5)
regression line (dashed): b = 29.9, m = 1.09, R² = 0.75

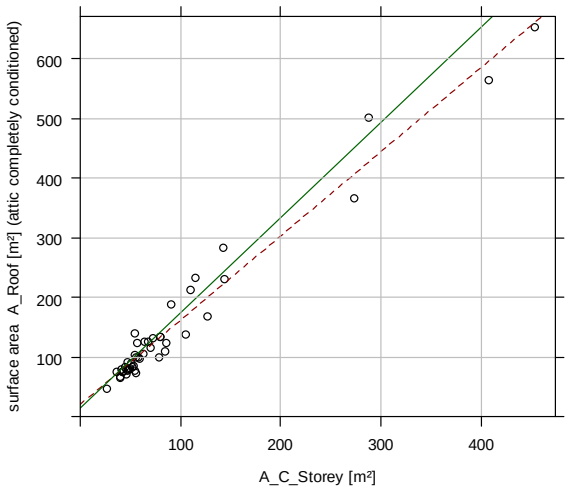


simplified parameters (solid line): b = 10, m = 1.4, R² = 0.56

(number of dasets not sufficient)

Roof
attic completely conditioned

surface area A_Roof [m²] (attic completely conditioned) ~ A_C_Storey [m²] (n=46)
regression line (dashed): b = 20.2, m = 1.41, R² = 0.96



simplified parameters (solid line): b = 15, m = 1.6, R² = 0.94

Figure 2: Results of the regression analysis for the envelope types window and façade

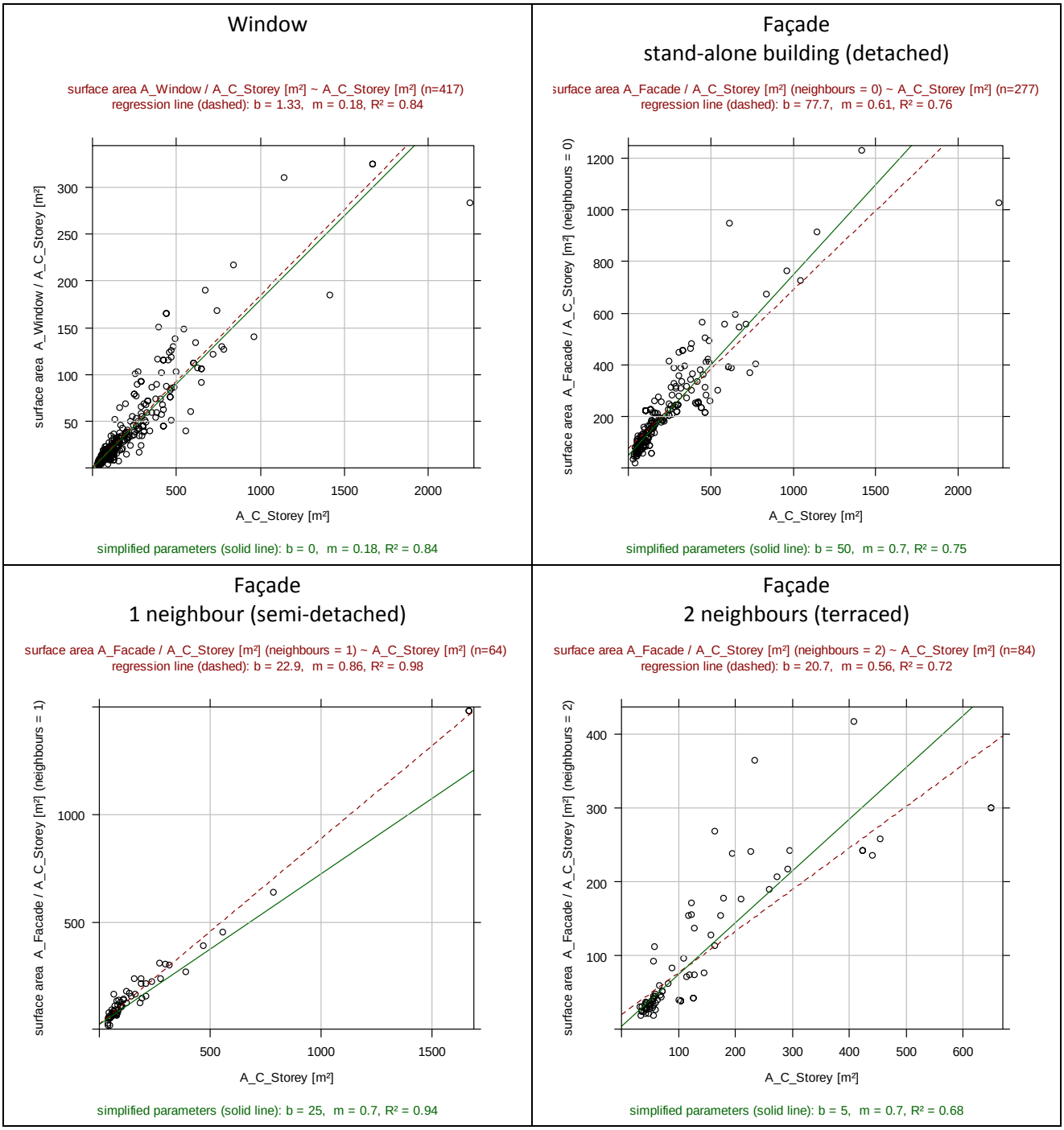
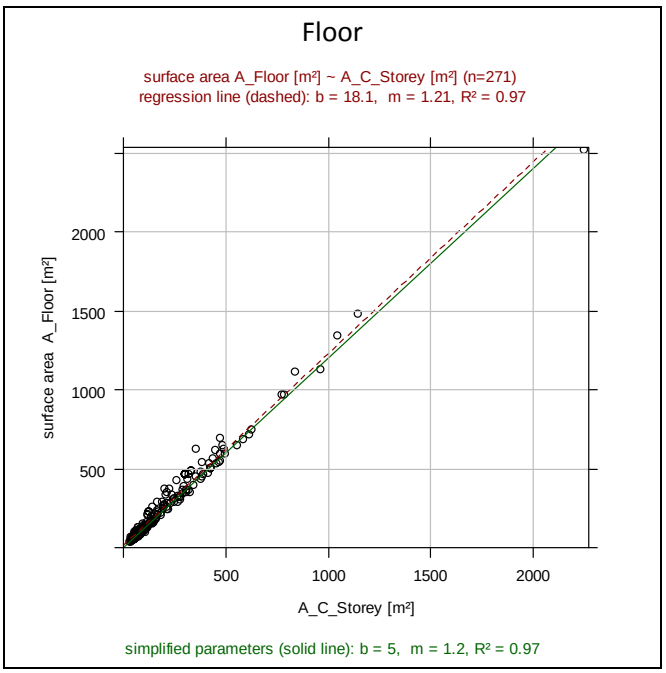


Figure 3: Results of the regression analysis for the envelope type floor



2.4 Overview of estimation parameters

The parameters of the regression lines are cited in the headings of the above shown charts.

In order to arrive at a simple estimation procedure rough numbers were assumed on the basis of the findings which take advantage of the similarities of dependencies. These ball park figures were tested as regards the coefficient of determination R^2. It turns out that the assumed lines approximate the real data points nearly as well as the results of the regression analysis.

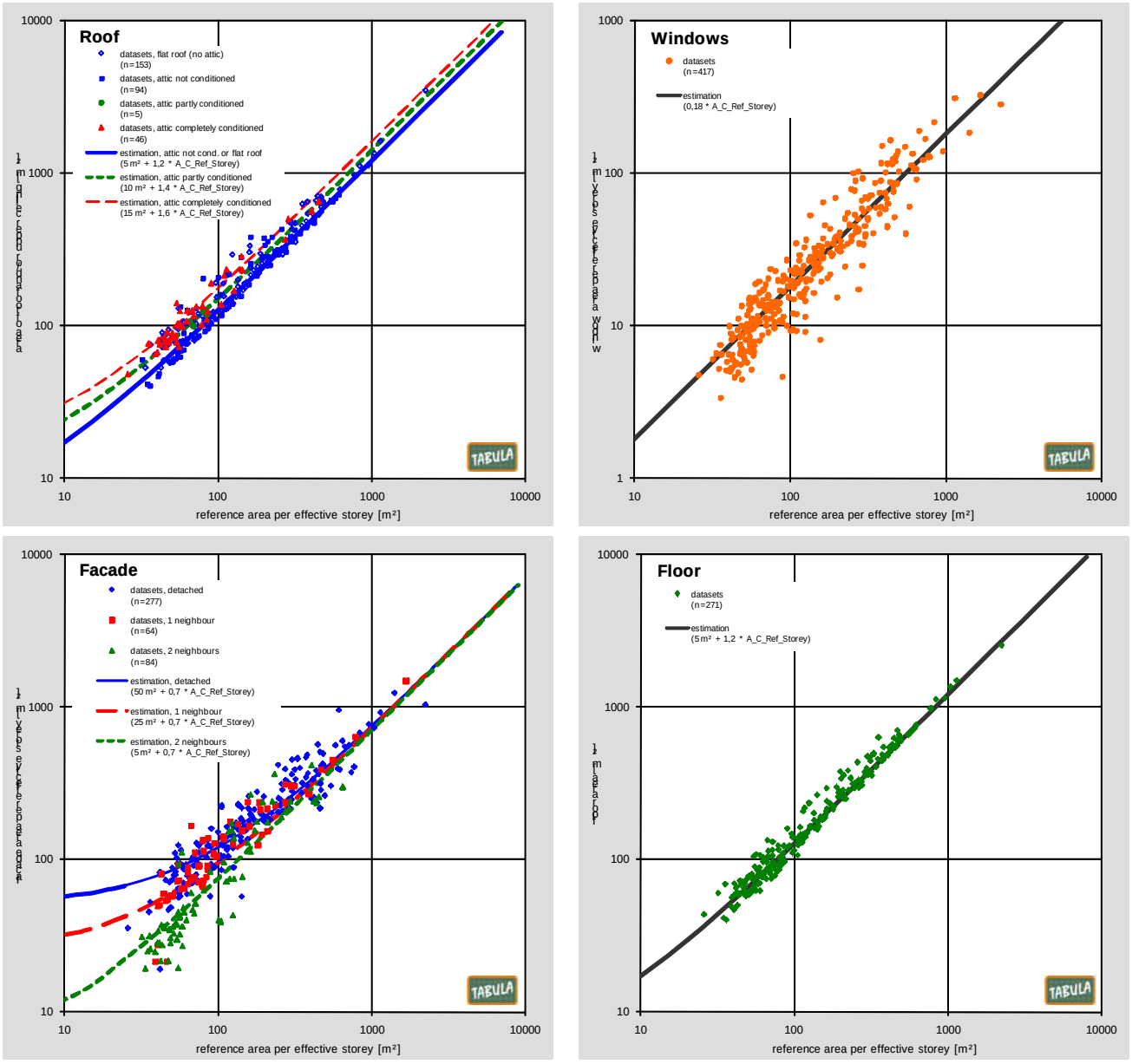
The values of intercept, slope and R^2 of the simplified prediction lines are mentioned in the footer of each chart. The following table gives a summary:

Table 6: Intercepts (b) and slopes (m) of the simplified model

Envelope type	Independent variable	Specification	b [m²]	m [-]
Roof	A_C_Storey	flat roof (no attic)	5	1,20
		attic not conditioned	5	1,20
		attic partly conditioned	10	1,40
		attic completely conditioned	15	1,60
Window	A_C_Ref		0	0,18
Façade	A_C_Ref	0 neighbours	50	0,70
		1 neighbours	25	0,70
		2 neighbours	5	0,70
Floor	A_C_Storey		5	1,20

The following charts illustrate how the simplified model lines are approximating the data points. Logarithmic scales are used for both axes in order to make the dependence also visible for smaller buildings.[4]

Figure 4: Data points and simplified model lines (double-logarithmic plots)



[4] On double logarithmic charts straight lines appear curved (with exception of the bisecting line).

3 Thermal Quality of Construction Elements and Insulation Measures

3.1 Example Buildings: Cross-Country Comparison of Average U-Values by Decades

The example-building database offers the opportunity to compare typical U-values for different time bands between countries. To attain this goal the following analysis has been conducted:

- For each example building average U-values have been determined for the four envelope types: roof, window, wall, floor.
- Mean U-values have then been calculated for all relevant decades by averaging over the example buildings representing the four building size classes. In case that a change of construction year class occurs during a decade the average was based on the concerning two construction year classes weighted by the respective share of years.

The following mean U-values have been calculated by use of this procedure (data source: sheet "Tab.Building"):

Table 7: Average U-values of example buildings by country and decade

decade	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI
	U-values of roofs [W/(m²K)]											
... 1900	1,46	2,42	1,55	1,46	0,52	0,85	2,88	1,01	2,15	0,83	0,34	1,63
1901 ... 1910	1,46	2,42	1,55	1,23	0,63	2,48	2,88	1,01	2,28	0,83	0,34	1,63
1911 ... 1920	1,39	2,42	1,55	1,20	0,63	2,46	2,88	1,01	2,28	0,83	0,34	1,63
1921 ... 1930	1,10	2,42	1,59	1,08	0,63	2,45	2,88	1,01	2,38	0,83	0,34	1,63
1931 ... 1940	1,10	2,42	1,59	1,08	0,82	2,45	2,88	1,01	2,38	0,83	0,34	1,63
1941 ... 1950	1,13	2,56	1,50	1,13	0,82	2,48	2,88	1,01	2,16	0,70	0,34	1,38
1951 ... 1960	1,15	2,70	1,40	1,14	0,42	2,30	2,88	1,01	1,95	0,57	0,34	1,14
1961 ... 1970	0,78	2,70	0,75	0,63	0,30	2,18	2,88	1,01	1,88	0,58	0,20	1,14
1971 ... 1980	0,78	0,90	0,75	0,54	0,30	2,08	2,88	0,82	1,45	0,60	0,20	1,11
1981 ... 1990	0,48	0,90	0,48	0,42	0,18	1,52	1,79	0,40	1,03	0,59	0,17	0,43
1991 ... 2000	0,29	0,55	0,40	0,38	0,18	1,40	1,79	0,34	0,70	0,48	0,12	0,43
	U-values of walls [W/(m²K)]											
... 1900	1,10	2,20	1,34	1,68	1,10	1,60	2,30	2,04	1,39	1,73	0,70	1,83
1901 ... 1910	1,10	2,20	1,34	1,83	1,12	2,45	2,30	2,04	1,48	1,73	0,70	1,83
1911 ... 1920	1,25	2,20	1,34	1,79	1,12	2,22	2,30	2,04	1,48	1,73	0,70	1,83
1921 ... 1930	1,84	2,20	1,37	1,63	1,12	2,13	2,30	2,04	1,56	1,73	0,70	1,83
1931 ... 1940	1,84	2,20	1,37	1,63	1,21	2,13	2,30	2,04	1,56	1,73	0,70	1,83
1941 ... 1950	1,50	1,95	1,39	1,55	1,21	2,10	2,30	2,04	1,57	1,67	0,70	1,56
1951 ... 1960	1,27	1,70	1,40	1,24	1,03	2,42	2,30	2,04	1,58	1,60	0,70	1,29
1961 ... 1970	1,29	1,70	1,06	1,15	0,64	2,34	2,30	2,04	1,27	1,42	0,38	1,29
1971 ... 1980	1,29	1,12	1,06	0,92	0,47	1,06	2,30	1,78	1,04	1,15	0,34	1,02
1981 ... 1990	0,83	1,12	0,63	0,61	0,37	0,52	1,44	0,74	0,80	1,10	0,28	0,48
1991 ... 2000	0,39	0,60	0,50	0,47	0,35	0,46	1,44	0,61	0,60	0,41	0,27	0,48
	U-values of windows [W/(m²K)]											
... 1900	2,2	5,0	2,4	3,0	2,7	4,4	4,7	5,3	5,1	5,0	2,3	2,4
1901 ... 1910	2,2	5,0	2,4	3,1	2,7	3,8	4,7	5,3	5,1	5,0	2,3	2,4
1911 ... 1920	2,1	5,0	2,4	3,2	2,7	3,8	4,7	5,3	5,1	5,0	2,3	2,4
1921 ... 1930	1,8	5,0	2,4	3,5	2,7	3,8	4,7	5,3	5,1	5,0	2,3	2,4
1931 ... 1940	1,8	5,0	2,4	3,5	2,6	3,8	4,7	5,3	5,1	5,0	2,3	2,4
1941 ... 1950	2,3	5,0	2,6	3,5	2,6	3,7	4,7	5,3	5,0	4,6	2,3	2,2
1951 ... 1960	2,7	5,0	2,8	3,5	2,7	3,7	4,7	5,3	4,9	4,2	2,3	2,1
1961 ... 1970	2,2	5,0	2,7	3,5	2,6	4,1	4,7	5,3	4,9	3,6	2,3	2,1
1971 ... 1980	2,2	3,9	2,7	3,5	2,6	3,8	4,7	4,8	4,1	2,6	2,1	2,2
1981 ... 1990	2,0	3,9	2,3	3,4	2,4	2,6	5,0	3,3	3,3	2,6	1,9	1,7
1991 ... 2000	1,3	3,5	1,9	2,4	2,3	2,2	5,0	2,9	2,8	1,8	1,9	1,7
	U-values of floors [W/(m²K)]											
... 1900	1,25	0,90	2,00	1,47	0,84	3,34	2,88	1,44	1,70	2,07	0,34	1,80
1901 ... 1910	1,25	0,90	2,00	1,20	1,00	2,20	2,88	1,44	1,95	2,07	0,34	1,80
1911 ... 1920	1,21	0,90	2,00	1,16	1,00	1,97	2,88	1,44	1,95	2,07	0,34	1,80
1921 ... 1930	1,05	0,90	1,50	1,00	1,00	1,87	2,88	1,44	1,95	2,07	0,34	1,80
1931 ... 1940	1,05	0,90	1,50	1,00	1,32	1,87	2,88	1,44	1,95	2,07	0,34	1,80
1941 ... 1950	1,57	0,90	1,45	1,17	1,32	1,93	2,88	1,44	1,71	1,88	0,34	1,62
1951 ... 1960	1,92	0,90	1,40	1,78	0,75	2,00	2,88	1,44	1,48	1,70	0,34	1,44
1961 ... 1970	0,88	0,90	1,28	1,48	0,65	1,61	2,88	1,44	1,65	1,60	0,30	1,44
1971 ... 1980	0,88	0,90	1,28	0,95	0,42	0,63	2,88	1,35	1,33	1,45	0,30	0,97
1981 ... 1990	0,61	0,90	0,98	0,65	0,27	0,62	2,47	1,14	1,00	1,35	0,27	0,69
1991 ... 2000	0,40	0,70	0,74	0,52	0,25	0,55	2,47	0,94	0,80	0,94	0,22	0,69

Figure 5: Comparison of average U-values of roofs and upper ceilings

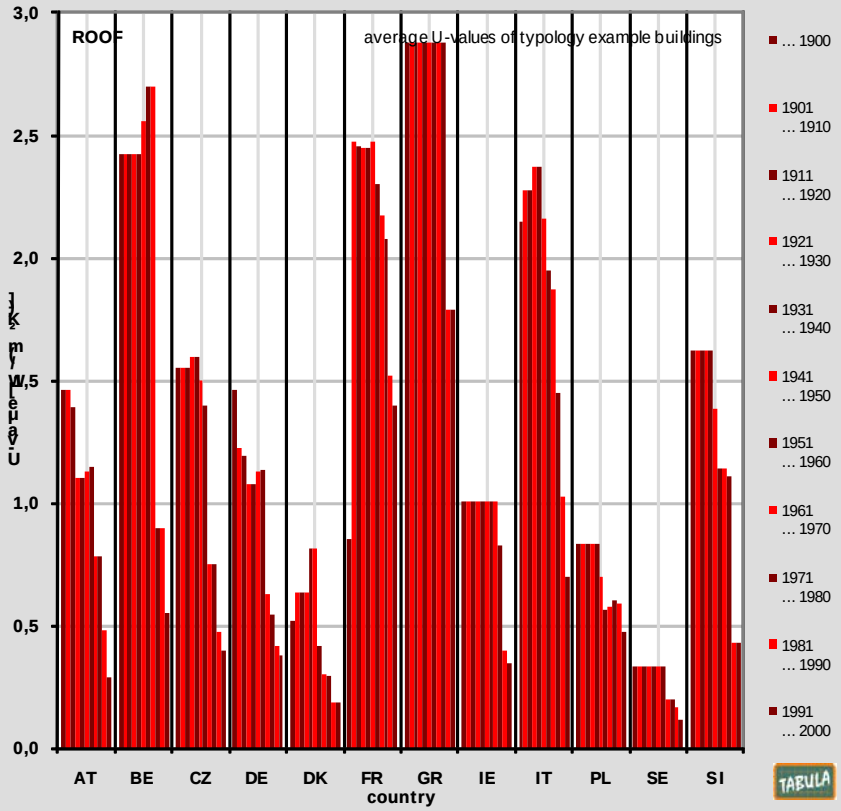


Figure 6: Comparison of average U-values of walls

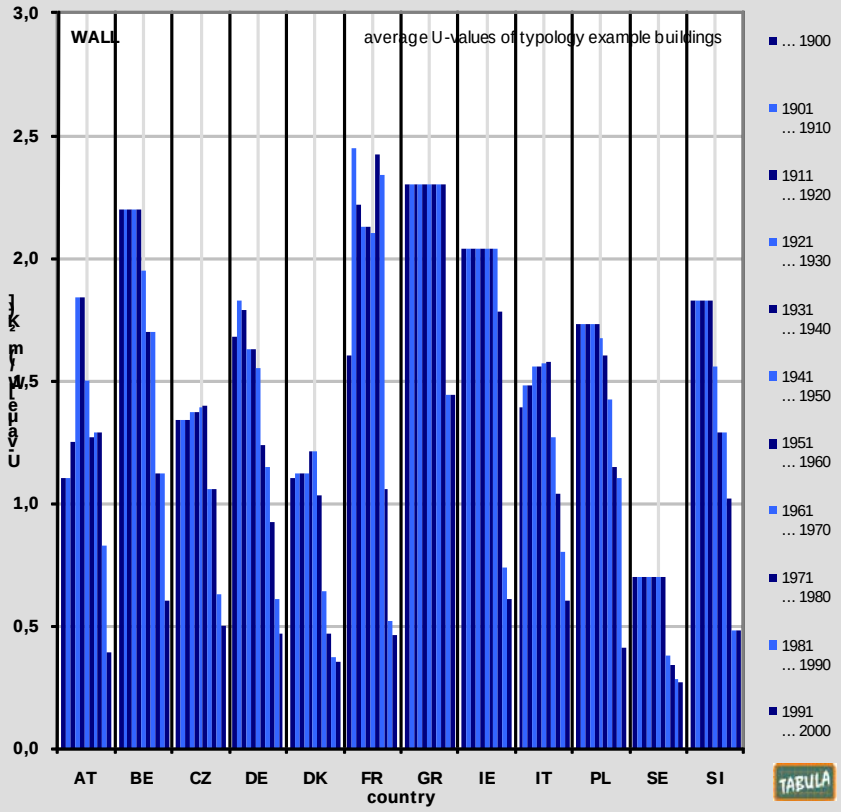


Figure 7: Comparison of average U-values of windows

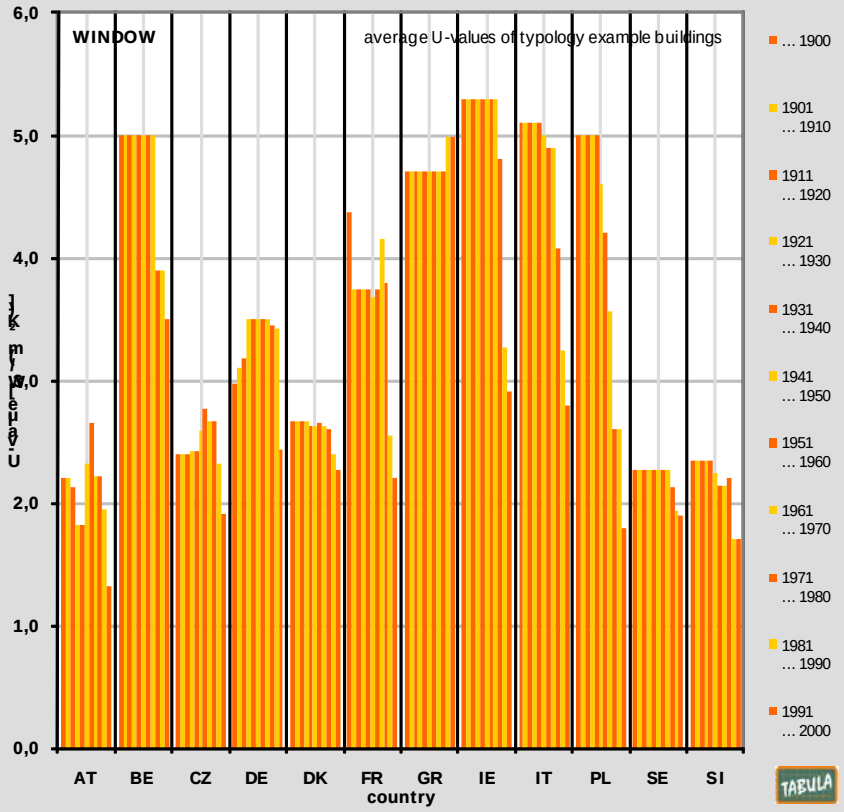
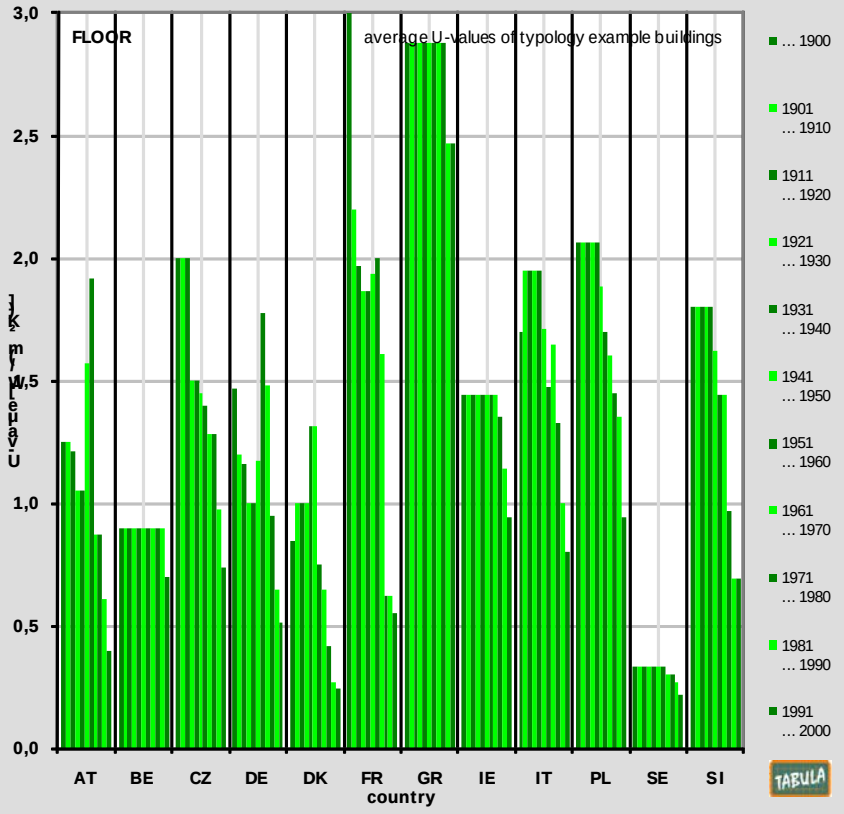


Figure 8: Comparison of average U-values of floors



3.2 Construction Database: Evaluation of U-values by Construction Type and National Period

The construction catalogue (sheet "Tab.Building.Constr") was analysed in the following way:

- For each building average U-values have been determined for the four construction types: roof, upper ceiling, wall, floor. If the information was available a differentiation was made between massive (structures of masonry, concrete, steel, …) and wooden (timber frame, wooden beam ceilings, rafters, …) constructions.
- Mean U-values have then be calculated for each national construction year class by averaging over the example buildings representing the four building size classes of the respective time band.

The following table shows the results:

Table 8: Evaluation of the construction catalogue / opaque elements

Country Code	Construction Year Class		Roof	Upper Ceiling	Wall	Floor
	Code	from ... to	massive / wooden	massive / wooden	massive / wooden	massive / wooden
			U-Value [W/m²K]			
AT	AT.01	... 1918	1,4	1,50	1,50	1,25
	AT.02	1919 ... 1944	0,95	1,70 / 1,05	1,73	1,55
	AT.03	1945 ... 1960	0,90	1,70 / 0,78	1,27	2,30
	AT.04	1961 ... 1980	0,60	1,67	1,18	0,95
	AT.05	1981 ... 1990	0,49	0,65	0,83	0,70
	AT.06	1991 ... 2000	0,29	0,30	0,31	0,50
BE	BE.01	... 1945	3,50 / 1,70	-	2,13	1,43
	BE.02	1946 ... 1970	3,50 / 1,80	-	1,70	0,85
	BE.03	1971 ... 1990	1,10	-	1,53 / 0,50	0,85
	BE.04	1991 ... 2005	0,59	-	0,68 / 0,50	0,75
CZ	CZ.01	... 1920	2,60	1,20	1,42	2,02
	CZ.02	1921 ... 1945	2,12	2,20	1,43	1,50
	CZ.03	1946 ... 1960	1,23	1,45 / 1,30	1,43	1,24
	CZ.04	1961 ... 1980	0,71	1,53	1,15	1,26
	CZ.05	1981 ... 1994	0,41	0,60	0,76	0,85
	CZ.06	1994 ...	0,30	-	0,38	0,49
DE	DE.01	... 1859	1,95	1,00	2,10	2,90 / 1,20
	DE.02	1860 ... 1918	1,95	1,00	2,10	2,90 / 1,20
	DE.03	1919 ... 1948	1,68	0,80	1,55	1,05
	DE.04	1949 ... 1957	1,40	1,85 / 0,80	1,27	1,77
	DE.05	1958 ... 1968	1,10	1,85 / 0,80	1,27	1,57
	DE.06	1969 ... 1978	0,60	0,60	1,07 / 0,60	1,00
	DE.07	1979 ... 1983	0,50	0,50	0,77 / 0,50	0,80
	DE.08	1984 ... 1994	0,40	0,40 / 0,30	0,63 / 0,40	0,60
	DE.09	1995 ... 2001	0,35	0,35 / 0,27	0,53 / 0,30	0,45
GR	GR.01	... 1980	2,27	-	2,72	1,91
	GR.02	1981 ... 2000	1,82 / 0,68	-	0,86	1,21
	GR.03	2001 ...	0,67	-	0,80	1,25
IE	IE.01	... 1977	2,30 / 1,49	-	2,04	1,41
	IE.02	1978 ... 1982	0,40	-	1,10	1,15
	IE.03	1983 ... 1993	0,40	-	0,60	1,15
	IE.04	1994 ... 2004	0,35 / 0,31	-	0,55	0,84
IT	IT.01	... 1900	1,80	2,37	1,61	1,93
	IT.02	1901 ... 1920	1,80	2,41	1,61	1,82
	IT.03	1921 ... 1945	2,03 / 1,80	2,00	1,31	1,65
	IT.04	1946 ... 1960	2,03	1,65	1,82	1,65
	IT.05	1961 ... 1975	2,03	1,65	1,82	1,65
	IT.06	1976 ... 1990	1,08 / 0,95	0,97	0,79	1,11
	IT.07	1991 ... 2005	0,72 / 0,64	0,69	0,60	0,85
PL	PL.01	... 1945	0,90 / 0,77	-	1,75 / 0,40	2,00
	PL.02	1946 ... 1966	0,53	-	1,29 / 0,40	1,65
	PL.03	1967 ... 1985	0,53	-	1,29 / 0,40	1,45
	PL.04	1986 ... 1992	0,43	-	0,98 / 0,40	1,25
	PL.05	1993 ... 2002	0,43	-	0,29	0,90
SE	SE.01	... 1960	-	0,33	0,83 / 0,53	0,32
	SE.02	1961 ... 1975	-	0,21	0,36	0,30
	SE.03	1976 ... 1985	-	0,16	0,27	0,28
	SE.04	1986 ... 1995	-	0,14	0,20	0,25
	SE.05	1996 ... 2005	-	0,13	0,20	0,20
SI	SI.01	... 1945	2,70	1,40 / 1,00	1,50 / 0,70	2,05
	SI.02	1946 ... 1970	1,80	1,23 / 1,00	1,60	1,40
	SI.03	1971 ... 1980	0,90	1,00	1,10 / 0,26	0,96
	SI.04	1981 ... 2001	0,43	0,46	0,48 / 0,21	0,65

The analysis of the windows was based on the same procedure. In this case the differentiation concerns the numbers of panes, the type of glazing (standard / low-e) and the frame type (see Table 9). The column "Common" is reflecting the average of the available values.

Table 9: Evaluation of the construction catalogue / windows

Number of panes	Special glazing	Frame type	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	Common
			U-Value window [W/m²K]												
1	-	not specified	-	-	-	-	-	-	4,7	-	-	-	-	-	4,7
	-	wood	4,6	5,0	-	3,9	4,4	4,2	-	-	4,9	4,5	-	5,2	4,6
	-	plastic	-	-	-	-	-	3,8	-	4,8	-	-	-	-	4,3
	-	metal	-	5,7	-	-	-	6,0	6,1	5,7	5,7	-	-	-	5,8
2	-	not specified	2,5	-	2,6	-	-	2,7	-	2,8	-	2,6	-	-	2,6
	-	wood	2,3	3,5	-	3,1	2,8	2,8	2,7	-	2,8	(1,8)	-	2,4	2,8
	-	plastic	(1,4)	(3,5)	-	(3,5)	-	-	3,1	3,1	-	(1,4)	-	2,6	2,9
	-	metal	-	4,3	-	4,3	-	-	3,9	3,7	3,7	-	-	-	4,0
	-	metal, thermal break	-	3,5	-	3,5	-	-	3,3	3,4	3,4	-	-	-	3,4
	low-e	not specified	-	-	1,3	-	-	-	-	1,9	-	-	-	-	1,6
	low-e	wood	-	1,6	-	1,5	1,7	-	(2,3)	-	2,2	-	-	1,5	1,7
	low-e	plastic	(1,2)	1,7	-	1,7	-	-	(2,9)	-	-	-	-	1,2	1,5
	low-e	metal	-	-	-	-	-	-	(4,0)	-	-	-	-	(1,5)	-
	low-e	metal, thermal break	-	-	-	1,7	-	-	2,9	-	2,4	-	-	-	2,3
3	-	wood	1,4	-	-	-	-	-	-	-	-	1,9	-	-	1,7
	low-e	wood	-	1,1	-	1,0	1,0	-	-	-	-	-	-	0,8	1,0
	low-e	plastic	-	1,1	-	1,0	-	-	-	-	-	-	-	0,7	0,9
	low-e	metal	-	-	-	-	-	-	-	-	-	-	-	0,9	0,9
	low-e	insulated ("passive house window")	0,8	0,9	-	0,8	-	-	-	-	-	-	-	-	0,8

Remarks
Values which deviate more than +/- 30% from the average are listed in brackets and are not considered in the column "Common".

The values are mostly very close, however in some cases large deviations can be observed. The deviations can in principle be explained by different window sizes, glazing distances, gas fillings and glass spacer types. Nevertheless, also errors might have occurred when entering the information into the data sheet.

This should be clarified by the partners during future data revisions.

The averages of the column "Common" can also serve as default values in case that no values are available in the database. However, it is strongly recommended to supply and use the respective national values, if any possible. During the revision process of the next years further datasets and classifications should be provided by the partners. Also information should be supplemented from which time on (a) metal windows were typically fabricated with thermal breaks and (b) low-e glazing was dominant.

Table 10: U-values of different window types / derived default values (simplified common values)

Number of panes	Glazing type	Frame type	Default U-value [W/(m²K)]
1	conventional	not specified	4,7
		wood	4,6
		plastic	4,3
		metal	5,8
2	conventional	not specified	2,6
		wood	2,8
		plastic	2,9
		metal	4,0
		metal, thermal break	3,4
	low-e	not specified	1,6
		wood	1,7
		plastic	1,5
		metal, thermal break	2,3
3	conventional	wood	1,7
	low-e	wood	1,0
		plastic	0,9
		metal	0,9
		insulated ("passive house window")	0,8

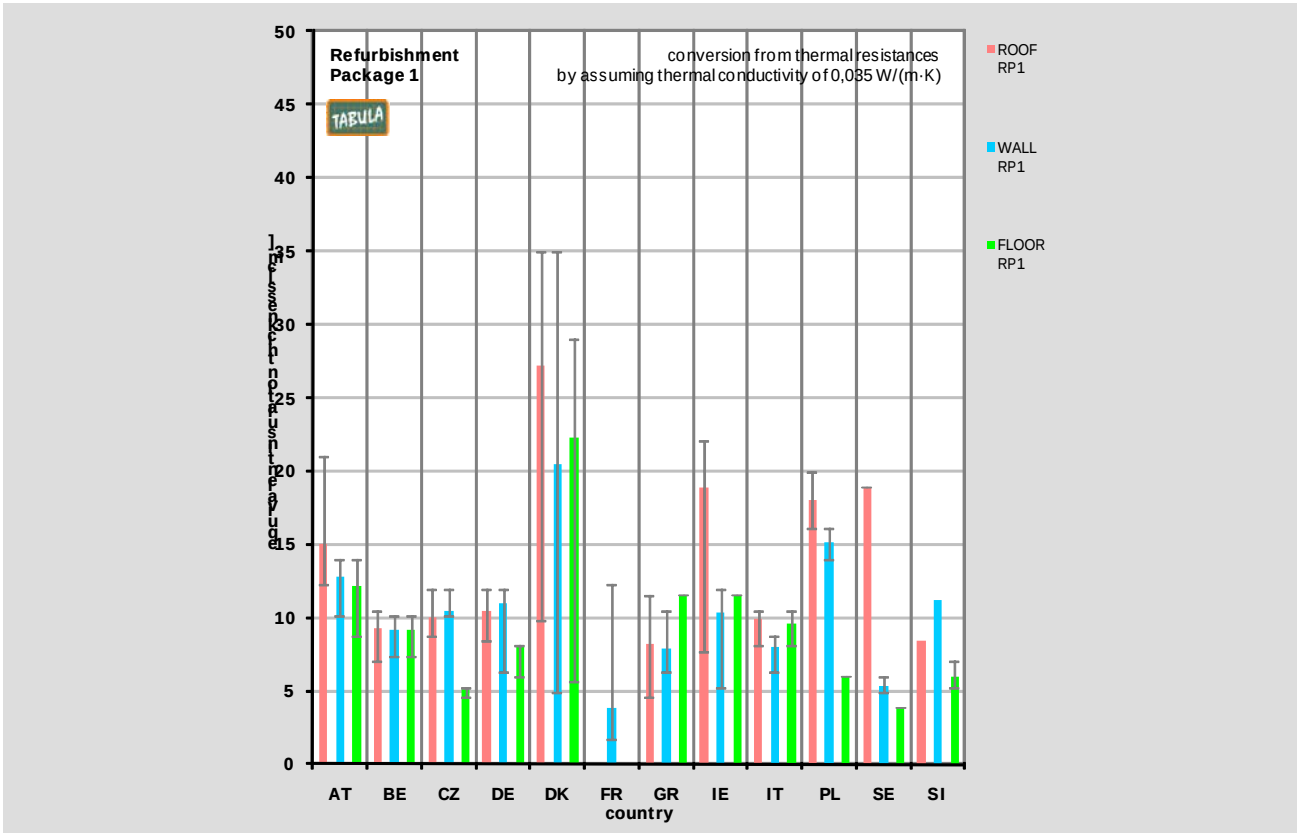
3.3 Measures for Upgrading the Thermal Envelope

The TABULA concept includes the definition of two levels of insulation measures:

- **Refurbishment Package 1: "Standard"**
  Package of measures for upgrading the thermal envelope and the heat supply system which are commonly realised during renovation;
- **Refurbishment Package 2: "Advanced":**
  Package of measures for upgrading the thermal envelope and the heat supply system, that are usually only realised in very ambitious renovations or research projects.

The insulation measure catalogue contains information about the type of measure and the thermal resistances. These values were transformed into equivalent insulation thicknesses in order to get more illustrative values (by applying a standard thermal conductivity of 0,035 W/(m·K)). The result is displayed in the following charts.

Figure 9: **Equivalent insulation thicknesses for roof, wall and floor / Refurbishment Package 1 "Standard" and 2 "Advanced".**



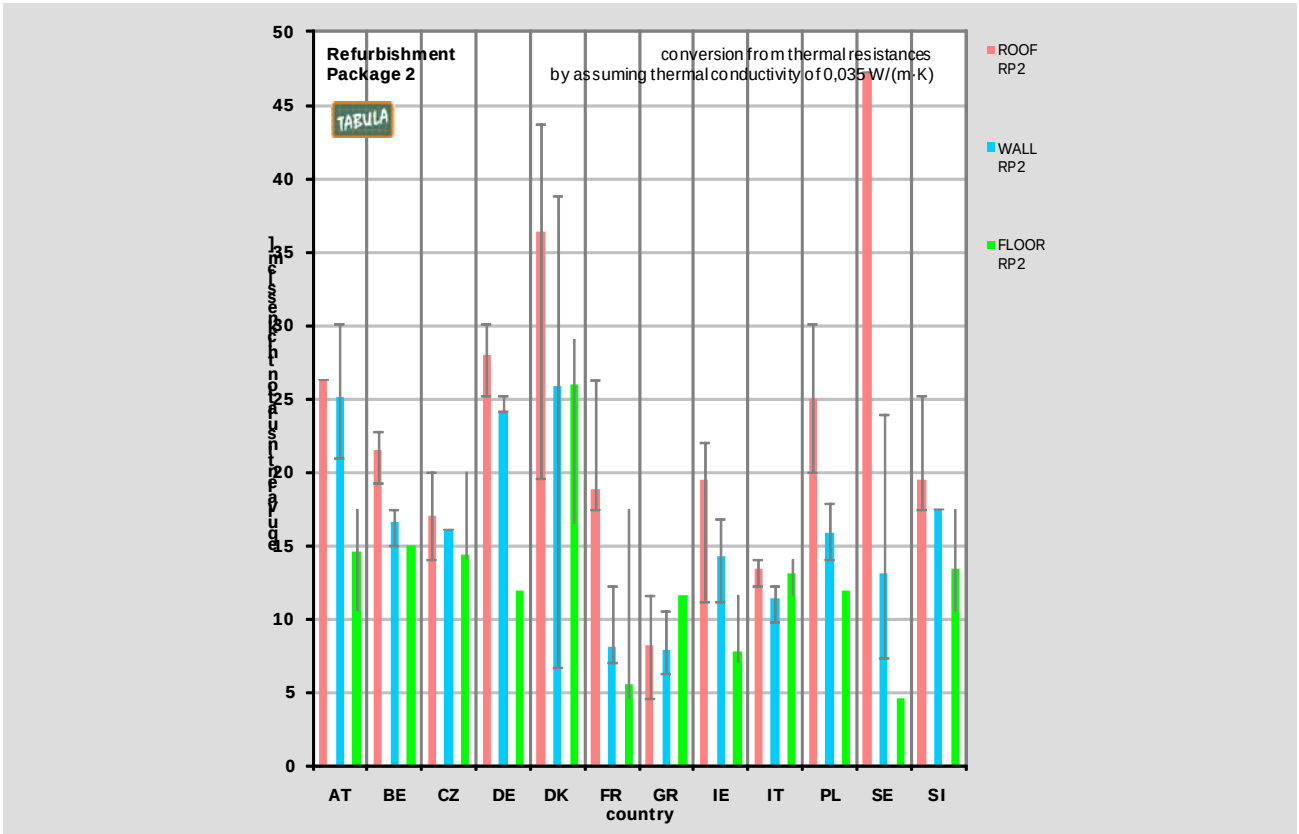
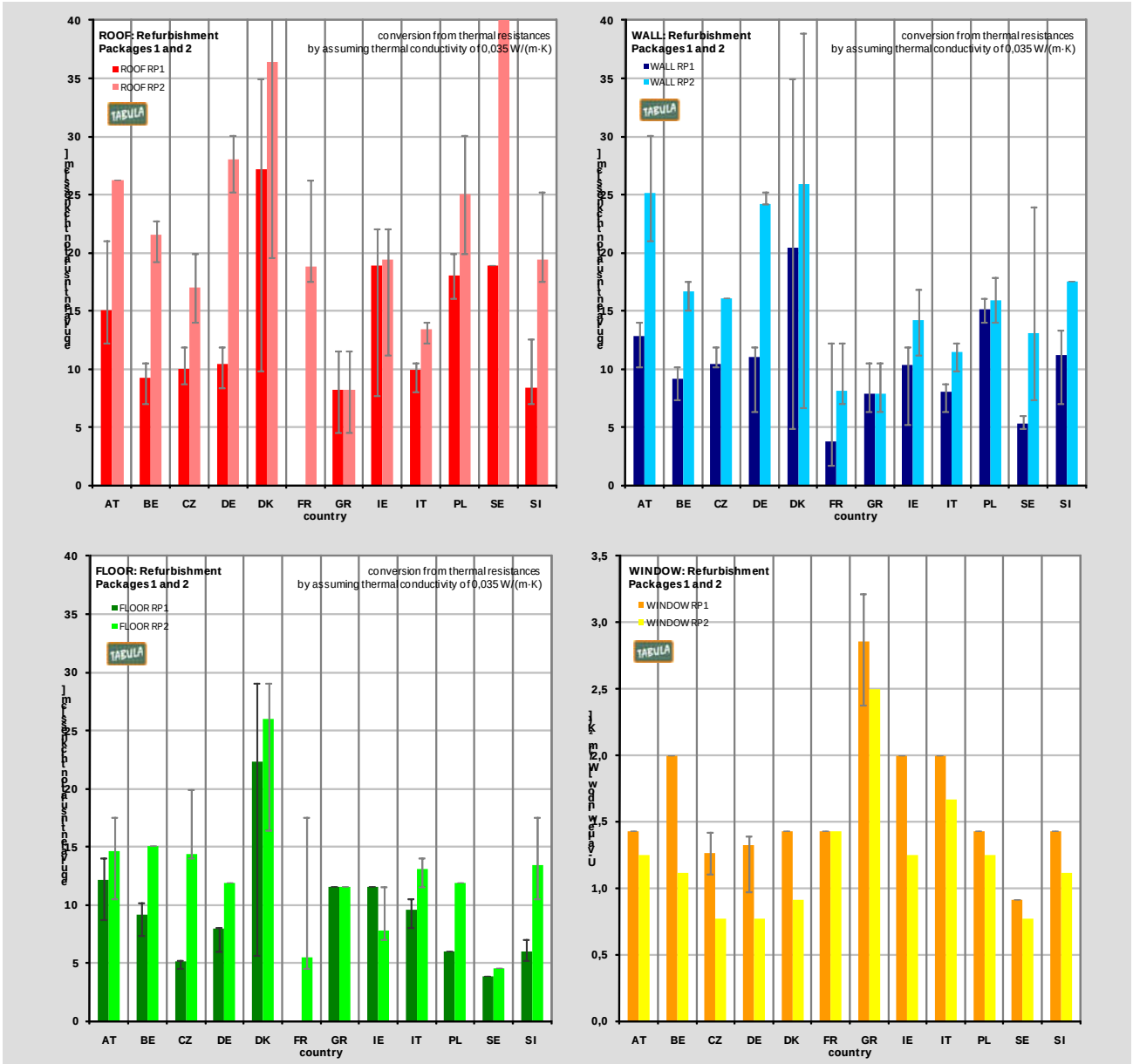


Figure 10: Refurbishment measures – separate comparison for each envelope type



4 Supply System Components

4.1 Description of the Proceeding

The evaluation of supply system characteristics was performed on the basis of 1203 datasets from 12 countries. The values had been determined by each partner on the basis of national methods.[5] The following components were considered:

- HG – Heating Systems / Heat Generation
- HS – Heating Systems / Heat Storage
- HD – Heating Systems / Heat Distribution
- HA – Heating Systems / Auxiliary Energy
- WG – Domestic Hot Water Systems / Heat Generation
- WS – DHW Systems / Heat Storage
- WD – Domestic Hot Water Systems / Heat Distribution
- WA – DHW Systems / Auxiliary Energy
- Vent – Ventilation Systems
- EC – Assessment Factors of Energy Carriers

For each of these components the data analysis comprised the following steps:

- **Overview of existing data:**
  A data analyses was performed by use of the programme "R". Minimum, maximum and average values were determined, differentiating between single and multi-family houses ("SUH" / "MUH"). The column "Common" reflects the values averaged over all countries and can later be used as default values. For this reason the minimum and maximum numbers in this column should not only be an average of all respective country values but also reflect possibly occurring extreme values of certain countries. Therefore the "Common" minimum and maximum values are determined by creating the mean value of (a) the average of all countries and (b) the most extreme value (of one country).
- **Condensed values:**
  In order to reduce the complexity some of the existing subgroups of component types were merged in so called "condensed values" which also do no more differentiate between single and multi-family houses. The averages and extreme values are now referred to as "poor", "medium" and "high" energy efficiency.
- **Simplified common values / default values:**
  As a last step the values of the column "Common" of each subsystem are transferred into a separate table ("default values / simplified common values"). These tabled values can in the future be useful for rough supranational estimations or in case that national values are not available. Nevertheless, the respective values should be provided for each country finally in order to reflect the specific national technology. After updating of the database the evaluation should be repeated in order to improve the reliability of the derived common values.

[5] see national scientific reports at: http://www.building-typology.eu/tabulapublications.html

4.2 HG – Heating Systems / Heat Generation

Table 11: Energy expenditure factors of heat generation (heating systems) differentiated by country and by building size class

			AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common	deviation
B	SUH	min	1,39	-	1,35	-	-	-	1,22	-	-	-	1,11	-	1,24	-10%
		average	1,41	-	1,57	-	-	-	1,39	-	-	-	1,11	-	1,37	
		max	1,43	-	1,82	-	-	-	1,64	-	-	-	1,11	-	1,56	+14%
	MUH	min	1,39	-	1,35	-	-	-	1,2	-	-	-	1,11	-	1,23	-10%
		average	1,41	-	1,57	-	-	-	1,37	-	-	-	1,11	-	1,37	-0%
		max	1,43	-	1,82	-	-	-	1,64	-	-	-	1,11	-	1,56	+15%
	deviation from "common"		+3%		+15%				+1%				-19%		0%	
B_NC	SUH	min	1,3	1,13	-	-	1,07	-	1,53	-	1,18	1,16	1,11	1,35	1,21	-7%
		average	1,31	1,39	-	-	1,12	-	1,53	-	1,32	1,16	1,21	1,35	1,30	
		max	1,33	2	-	-	1,16	-	1,53	-	1,53	1,16	1,4	1,35	1,50	+15%
	MUH	min	1,3	1,13	-	-	-	-	1,53	-	1,18	1,16	1,11	1,35	1,23	-7%
		average	1,31	1,39	-	-	-	-	1,53	-	1,32	1,16	1,21	1,35	1,32	+2%
		max	1,33	2	-	-	-	-	1,53	-	1,57	1,16	1,4	1,35	1,54	+16%
	deviation from "common"		-0%	+6%			-15%		+17%		+1%	-12%	-8%	+3%	0%	
B_NC_CT	SUH	min	1,33	1,42	1,28	1,37	1,07	1,65	1,14	1,25	-	-	-	1,2	1,28	-10%
		average	1,35	1,5	1,37	1,42	1,3	1,96	1,27	1,44	-	-	-	1,2	1,42	
		max	1,37	1,58	1,43	1,46	1,54	2,12	1,5	1,62	-	-	-	1,2	1,59	+12%
	MUH	min	1,33	1,42	1,28	1,25	1,14	1,83	1,14	1,4	-	-	-	1,2	1,31	-8%
		average	1,35	1,5	1,37	1,29	1,34	2,01	1,27	1,51	-	-	-	1,2	1,43	+0%
		max	1,37	1,58	1,43	1,32	1,54	2,23	1,5	1,62	-	-	-	1,2	1,60	+12%
	deviation from "common"		-5%	+5%	-4%	-5%	-7%	+39%	-11%	+4%				-16%	0%	
B_NC_LT	SUH	min	1,25	-	1,25	1,23	-	1,46	1,11	-	-	1,22	-	1,1	1,22	-6%
		average	1,28	-	1,29	1,29	-	1,46	1,14	-	-	1,49	-	1,1	1,29	
		max	1,3	-	1,33	1,35	-	1,46	1,19	-	-	1,75	-	1,1	1,40	+9%
	MUH	min	1,25	-	1,25	1,18	-	-	1,11	-	-	-	-	1,1	1,17	-4%
		average	1,28	-	1,29	1,23	-	-	1,14	-	-	-	-	1,1	1,21	-7%
		max	1,3	-	1,33	1,29	-	-	1,19	-	-	-	-	1,1	1,26	+4%
	deviation from "common"		+2%		+3%	+1%		+17%	-9%			+19%		-12%	0%	
B_C	SUH	min	1,12	1,04	1,05	1,08	1,02	1,41	1,04	1,11	1,14	1,04	-	0,98	1,08	-4%
		average	1,13	1,05	1,07	1,16	1,04	1,41	1,1	1,11	1,14	1,17	-	1,08	1,13	
		max	1,14	1,07	1,09	1,21	1,05	1,41	1,15	1,11	1,14	1,43	-	1,18	1,20	+6%
	MUH	min	1,12	1,04	1,05	1,06	1,05	-	1,04	1,11	1,14	1,04	-	0,98	1,06	-4%
		average	1,13	1,05	1,07	1,13	1,05	-	1,1	1,11	1,14	1,08	-	1,08	1,09	-3%
		max	1,14	1,07	1,09	1,17	1,05	-	1,15	1,11	1,14	1,12	-	1,18	1,13	+3%
	deviation from "common"		+1%	-6%	-4%	+3%	-6%	+27%	-1%	-0%	+2%	+1%		-3%	0%	
B_WP	SUH	min	1,34	-	1,33	1,37	-	2,62	-	-	1,4	1,33	1,25	1,2	1,45	-6%
		average	1,34	-	1,33	1,37	-	2,62	-	-	1,42	1,43	1,25	1,6	1,55	
		max	1,34	-	1,33	1,37	-	2,62	-	-	1,44	1,59	1,25	2	1,73	+12%
	MUH	min	1,34	-	1,33	1,25	-	-	-	-	1,4	1,18	1,25	1,2	1,27	-5%
		average	1,34	-	1,33	1,25	-	-	-	-	1,42	1,18	1,25	1,6	1,34	-13%
		max	1,34	-	1,33	1,25	-	-	-	-	1,44	1,18	1,25	2	1,47	+10%
	deviation from "common"		-7%		-8%	-9%		+82%			-2%	-9%	-13%	+11%	0%	
G_IWH	SUH	min	-	-	-	-	-	-	1,27	-	-	-	-	-	1,27	0%
		average	-	-	-	-	-	-	1,27	-	-	-	-	-	1,27	
		max	-	-	-	-	-	-	1,27	-	-	-	-	-	1,27	0%
	MUH	min	-	-	-	-	-	-	1,27	-	-	-	-	-	1,27	0%
		average	-	-	-	-	-	-	1,27	-	-	-	-	-	1,27	0%
		max	-	-	-	-	-	-	1,27	-	-	-	-	-	1,27	0%
	deviation from "common"								0%						0%	
G_IWH_NC	SUH	min	-	-	-	1,18	-	-	1,25	-	-	-	-	-	1,20	-3%
		average	-	-	-	1,23	-	-	1,25	-	-	-	-	-	1,24	
		max	-	-	-	1,27	-	-	1,25	-	-	-	-	-	1,26	+2%
	MUH	min	-	-	-	1,18	-	-	1,25	-	-	-	-	-	1,20	-3%
		average	-	-	-	1,23	-	-	1,25	-	-	-	-	-	1,24	0%
		max	-	-	-	1,27	-	-	1,25	-	-	-	-	-	1,26	+2%
	deviation from "common"					-1%			+1%						0%	
G_IWH_C	SUH	min	-	-	-	1,09	-	-	1,12	-	-	-	-	-	1,10	-3%
		average	-	-	-	1,14	-	-	1,12	-	-	-	-	-	1,13	
		max	-	-	-	1,18	-	-	1,12	-	-	-	-	-	1,16	+3%
	MUH	min	-	-	-	1,09	-	-	1,12	-	-	-	-	-	1,10	-3%
		average	-	-	-	1,14	-	-	1,12	-	-	-	-	-	1,13	0%
		max	-	-	-	1,18	-	-	1,12	-	-	-	-	-	1,16	+3%
	deviation from "common"					+1%			-1%						0%	
G_SH	SUH	min	1,59	-	-	1,4	-	-	1,46	-	-	-	-	1,18	1,36	-3%
		average	1,59	-	-	1,4	-	-	1,46	-	-	-	-	1,18	1,41	
		max	1,59	-	-	1,4	-	-	1,46	-	-	-	-	1,18	1,44	+3%
	MUH	min	1,59	-	-	1,4	-	-	1,46	-	-	-	-	1,18	1,36	-3%
		average	1,59	-	-	1,4	-	-	1,46	-	-	-	-	1,18	1,41	0%
		max	1,59	-	-	1,4	-	-	1,46	-	-	-	-	1,18	1,44	+3%
	deviation from "common"		+13%			-1%			+4%					-16%	0%	

			AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common	deviation
E	SUH	min	1,01	1	-	-	1	-	0,29	-	-	1	1	-	0,80	-17%
		average	1,01	1	-	-	1	-	0,74	-	-	1	1	-	0,96	
		max	1,01	1	-	-	1	-	1,05	-	-	1	1	-	1,02	+6%
	MUH	min	1,01	1	-	-	1	-	0,28	-	-	1	1	-	0,80	-17%
		average	1,01	1	-	-	1	-	0,75	-	-	1	1	-	0,96	+0%
		max	1,01	1	-	-	1	-	1,05	-	-	1	1	-	1,02	+6%
	deviation from "common"		+5%	+4%			+4%		-22%			+4%	+4%		0%	
E_Immersion	SUH	min	-	-	-	1	-	-	1	-	-	-	1,02	-	1,01	-2%
		average	-	-	-	1	-	-	1,06	-	-	-	1,02	-	1,03	
		max	-	-	-	1	-	-	1,11	-	-	-	1,02	-	1,06	+3%
	MUH	min	-	-	-	1	-	-	1	-	-	-	1,02	-	1,01	-2%
		average	-	-	-	1	-	-	1,06	-	-	-	1,02	-	1,03	0%
		max	-	-	-	1	-	-	1,11	-	-	-	1,02	-	1,06	+3%
	deviation from "common"					-3%			+3%				-1%		0%	
E_Storage	SUH	min	-	-	1	1	-	-	1	1	-	1,01	-	-	1,00	-1%
		average	-	-	1	1	-	-	1,03	1	-	1,01	-	-	1,01	
		max	-	-	1	1	-	-	1,05	1	-	1,01	-	-	1,02	+1%
	MUH	min	-	-	1	1	-	-	1	1	-	1,01	-	-	1,00	-1%
		average	-	-	1	1	-	-	1,03	1	-	1,01	-	-	1,01	0%
		max	-	-	1	1	-	-	1,05	1	-	1,01	-	-	1,02	+1%
	deviation from "common"				-1%	-1%			+2%	-1%		+0%			0%	
E_UnderFloor	SUH	min	-	-	-	-	-	-	1	-	-	1,05	-	-	1,02	-1%
		average	-	-	-	-	-	-	1	-	-	1,05	-	-	1,03	
		max	-	-	-	-	-	-	1	-	-	1,05	-	-	1,03	+1%
	MUH	min	-	-	-	-	-	-	1	-	-	1,05	-	-	1,02	-1%
		average	-	-	-	-	-	-	1	-	-	1,05	-	-	1,03	0%
		max	-	-	-	-	-	-	1	-	-	1,05	-	-	1,03	+1%
	deviation from "common"								-2%			+2%			0%	
E_SH	SUH	min	-	-	-	1	-	1,06	1	1	-	-	-	-	1,01	-0%
		average	-	-	-	1	-	1,06	1	1	-	-	-	-	1,02	
		max	-	-	-	1	-	1,06	1	1	-	-	-	-	1,02	+1%
	MUH	min	-	-	-	1	-	1,06	1	-	-	-	-	-	1,02	-7%
		average	-	-	-	1	-	1,26	1	-	-	-	-	-	1,09	+7%
		max	-	-	-	1	-	1,45	1	-	-	-	-	-	1,23	+13%
	deviation from "common"					-5%		+10%	-5%	-5%					0%	
HP	SUH	min	-	-	-	-	-	-	0,5	-	-	-	-	-	0,50	0%
		average	-	-	-	-	-	-	0,5	-	-	-	-	-	0,50	
		max	-	-	-	-	-	-	0,5	-	-	-	-	-	0,50	0%
	MUH	min	-	-	-	-	-	-	0,5	-	-	-	-	-	0,50	0%
		average	-	-	-	-	-	-	0,5	-	-	-	-	-	0,50	0%
		max	-	-	-	-	-	-	0,5	-	-	-	-	-	0,50	0%
	deviation from "common"								0%						0%	
HP_Air	SUH	min	0,29	0,37	0,35	0,35	0,29	0,45	0,29	0,38	0,4	-	0,4	0,36	0,35	-7%
		average	0,29	0,37	0,39	0,4	0,29	0,45	0,44	0,38	0,4	-	0,4	0,36	0,38	
		max	0,29	0,37	0,42	0,45	0,29	0,45	0,59	0,38	0,4	-	0,4	0,36	0,42	+10%
	MUH	min	0,29	0,37	0,35	0,35	0,29	0,45	0,29	0,26	0,4	-	0,4	0,36	0,34	-8%
		average	0,29	0,37	0,39	0,4	0,29	0,45	0,44	0,26	0,4	-	0,4	0,36	0,37	-3%
		max	0,29	0,37	0,42	0,45	0,29	0,45	0,59	0,26	0,4	-	0,4	0,36	0,41	+10%
	deviation from "common"		-22%	-1%	+4%	+7%	-22%	+20%	+18%	-14%	+7%		+7%	-4%	0%	
HP_Ground	SUH	min	0,25	0,26	0,29	0,29	0,25	0,29	0,14	0,36	0,33	0,29	0,33	0,29	0,27	-11%
		average	0,25	0,47	0,31	0,32	0,25	0,29	0,17	0,36	0,33	0,29	0,33	0,29	0,31	
		max	0,25	0,7	0,32	0,36	0,25	0,29	0,19	0,36	0,33	0,29	0,33	0,29	0,36	+18%
	MUH	min	0,25	0,26	0,29	0,29	0,25	0,29	0,14	-	0,33	0,29	0,33	0,29	0,26	-13%
		average	0,25	0,47	0,31	0,32	0,25	0,29	0,17	-	0,33	0,29	0,33	0,29	0,30	-2%
		max	0,25	0,7	0,32	0,36	0,25	0,29	0,19	-	0,33	0,29	0,33	0,29	0,36	+19%
	deviation from "common"		-17%	+55%	+2%	+6%	-17%	-4%	-44%	+19%	+9%	-4%	+9%	-4%	0%	
HP_ExhAir	SUH	min	-	-	-	-	-	-	0,29	-	-	0,38	0,33	-	0,32	-3%
		average	-	-	-	-	-	-	0,29	-	-	0,38	0,33	-	0,33	
		max	-	-	-	-	-	-	0,29	-	-	0,38	0,33	-	0,35	+4%
	MUH	min	-	-	-	-	-	-	0,29	-	-	-	0,33	-	0,30	-2%
		average	-	-	-	-	-	-	0,29	-	-	-	0,33	-	0,31	-7%
		max	-	-	-	-	-	-	0,29	-	-	-	0,33	-	0,32	+2%
	deviation from "common"								-10%			+18%	+3%		0%	
HP_Water	SUH	min	0,25	0,24	-	-	-	-	0,25	-	-	-	-	-	0,25	-17%
		average	0,25	0,39	-	-	-	-	0,25	-	-	-	-	-	0,30	
		max	0,25	0,53	-	-	-	-	0,25	-	-	-	-	-	0,39	+31%
	MUH	min	0,25	0,24	-	-	-	-	0,25	-	-	-	-	-	0,25	-17%
		average	0,25	0,39	-	-	-	-	0,25	-	-	-	-	-	0,30	0%
		max	0,25	0,53	-	-	-	-	0,25	-	-	-	-	-	0,39	+31%
	deviation from "common"		-16%	+31%					-16%						0%	
HP_Other	SUH	min	-	-	-	-	-	-	-	-	-	-	-	-	FALSE	
		average	-	-	-	-	-	-	-	-	-	-	-	-	0,00	
		max	-	-	-	-	-	-	-	-	-	-	-	-	FALSE	
	MUH	min	-	-	-	-	-	-	-	-	-	-	-	-	FALSE	
		average	-	-	-	-	-	-	-	-	-	-	-	-	0,00	
		max	-	-	-	-	-	-	-	-	-	-	-	-	FALSE	
	deviation from "common"															

			AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common	deviation
Stove	SUH	min	-	1,34	-	-	-	-	1,1	-	-	-	-	-	1,18	-13%
		average	-	1,37	-	-	-	-	1,33	-	-	-	-	-	1,35	
		max	-	1,39	-	-	-	-	1,57	-	-	-	-	-	1,51	+12%
	MUH	min	-	1,34	-	-	-	-	1,1	-	-	-	-	-	1,18	-13%
		average	-	1,37	-	-	-	-	1,33	-	-	-	-	-	1,35	0%
		max	-	1,39	-	-	-	-	1,57	-	-	-	-	-	1,51	+12%
	deviation from "common"			+1%					-1%						0%	
Stove_L	SUH	min	1,52	1,41	-	1,4	-	-	1,07	-	-	1,19	-	-	1,28	-8%
		average	1,52	1,46	-	1,4	-	-	1,3	-	-	1,26	-	-	1,39	
		max	1,52	1,51	-	1,4	-	-	1,53	-	-	1,33	-	-	1,47	+6%
	MUH	min	1,52	1,41	-	1,4	-	-	1,07	-	-	1,19	-	-	1,28	-8%
		average	1,52	1,46	-	1,4	-	-	1,3	-	-	1,26	-	-	1,39	0%
		max	1,52	1,51	-	1,4	-	-	1,53	-	-	1,33	-	-	1,47	+6%
	deviation from "common"		+10%	+5%		+1%			-6%			-9%			0%	
Stove_S	SUH	min	1,67	1,56	-	1,6	-	3,76	1,43	-	1,79	1,67	-	-	1,86	-9%
		average	1,96	1,73	-	1,6	-	3,76	1,43	-	2,12	1,67	-	-	2,04	
		max	2,22	1,81	-	1,6	-	3,76	1,43	-	2,5	1,67	-	-	2,34	+15%
	MUH	min	1,67	1,56	-	1,6	-	-	1,43	-	1,79	1,67	-	-	1,59	-9%
		average	1,96	1,73	-	1,6	-	-	1,43	-	2,12	1,67	-	-	1,75	-14%
		max	2,22	1,81	-	1,6	-	-	1,43	-	2,5	1,67	-	-	1,96	+12%
	deviation from "common"		+3%	-9%		-16%		+98%	-25%		+12%	-12%			0%	
OpenFire	SUH	min	-	-	-	-	-	-	2	3,33	-	3,33	-	-	2,67	-21%
		average	-	-	-	-	-	-	3,5	3,33	-	3,33	-	-	3,39	
		max	-	-	-	-	-	-	5	3,33	-	3,33	-	-	4,17	+23%
	MUH	min	-	-	-	-	-	-	2	-	-	3,33	-	-	2,44	-28%
		average	-	-	-	-	-	-	3,5	-	-	3,33	-	-	3,42	+1%
		max	-	-	-	-	-	-	5	-	-	3,33	-	-	4,44	+30%
	deviation from "common"								+3%	-2%		-2%			0%	
TS	SUH	min	1,02	-	1,02	1,02	1,03	-	1,05	-	-	1,01	1,33	1	1,05	-3%
		average	1,02	-	1,04	1,02	1,05	-	1,15	-	-	1,05	1,33	1	1,08	
		max	1,02	-	1,05	1,02	1,06	-	1,25	-	-	1,08	1,33	1	1,13	+4%
	MUH	min	1,02	-	1,02	1,02	1,03	1,53	1,05	-	1,09	1,01	1,33	1	1,10	-2%
		average	1,02	-	1,04	1,02	1,05	1,53	1,15	-	1,09	1,05	1,33	1	1,13	+4%
		max	1,02	-	1,05	1,02	1,06	1,53	1,25	-	1,09	1,08	1,33	1	1,18	+4%
	deviation from "common"		-8%		-6%	-8%	-5%	+38%	+4%		-1%	-5%	+20%	-10%	0%	
CHP	SUH	min	-	-	1,67	1,67	-	-	1,18	-	-	-	-	-	1,43	-7%
		average	-	-	1,67	1,67	-	-	1,24	-	-	-	-	-	1,53	
		max	-	-	1,67	1,67	-	-	1,3	-	-	-	-	-	1,58	+3%
	MUH	min	-	-	1,67	1,67	-	-	1,18	-	-	-	-	-	1,43	-7%
		average	-	-	1,67	1,67	-	-	1,24	-	-	-	-	-	1,53	0%
		max	-	-	1,67	1,67	-	-	1,3	-	-	-	-	-	1,58	+3%
	deviation from "common"				+9%	+9%			-19%						0%	
Solar	SUH	min	0	-	-	0	0	-	0	-	0	-	0	0	0,00	
		average	0	-	-	0	0	-	0	-	0	-	0	0	0,00	
		max	0	-	-	0	0	-	0	-	0	-	0	0	0,00	
	MUH	min	0	-	-	0	0	-	0	-	0	-	0	0	0,00	
		average	0	-	-	0	0	-	0	-	0	-	0	0	0,00	
		max	0	-	-	0	0	-	0	-	0	-	0	0	0,00	
	deviation from "common"															

Table 12: Deviations from averages ("common values") per country

	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI
B	+3%		+15%				+1%				-19%	
B_NC	-0%	+6%			-15%		+17%		+1%	-12%	-8%	+3%
B_NC_CT	-5%	+5%	-4%	-5%	-7%	+39%	-11%	+4%				-16%
B_NC_LT	+2%		+3%	+1%		+17%	-9%			+19%		-12%
B_C	+1%	-6%	-4%	+3%	-6%	+27%	-1%	-0%	+2%	+1%		-3%
B_WP	-7%		-8%	-9%		+82%			-2%	-9%	-13%	+11%
G_IWH							0%					
G_IWH_NC				-1%			+1%					
G_IWH_C				+1%			-1%					
G_SH	+13%			-1%			+4%					-16%
E	+5%	+4%			+4%		-22%			+4%	+4%	
E_Immersion				-3%			+3%				-1%	
E_Storage			-1%	-1%			+2%	-1%		+0%		
E_UnderFloor							-2%			+2%		
E_SH				-5%		+10%	-5%	-5%				
HP							0%					
HP_Air	-22%	-1%	+4%	+7%	-22%	+20%	+18%	-14%	+7%		+7%	-4%
HP_Ground	-17%	+55%	+2%	+6%	-17%	-4%	-44%	+19%	+9%	-4%	+9%	-4%
HP_ExhAir							-10%			+18%	+3%	
HP_Water	-16%	+31%					-16%					
HP_Other												
Stove		+1%					-1%					
Stove_L	+10%	+5%		+1%			-6%			-9%		
Stove_S	+3%	-9%		-16%		+98%	-25%		+12%	-12%		
OpenFire							+3%	-2%		-2%		
TS	-8%		-6%	-8%	-5%	+38%	+4%		-1%	-5%	+20%	-10%
CHP			+9%	+9%			-19%					
Solar												

Table 13: Energy expenditure factors heat generation (heating systems) / merged and condensed values

heat generator type		energy efficiency	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common
B_NC	boiler, non-condensing	poor	1,37	2,00	1,43	1,46	1,54	2,23	1,53	1,62	1,57	1,75	1,40	1,35	1,92
		medium	1,31	1,45	1,33	1,31	1,25	1,81	1,31	1,48	1,32	1,27	1,21	1,22	1,36
		high	1,25	1,13	1,25	1,18	1,07	1,46	1,11	1,25	1,18	1,16	1,11	1,10	1,13
	consideration in "common"		1	1	1	1	1	1	1	1	1	1	1	1	n=12
B_C	boiler, condensing	poor	1,14	1,07	1,09	1,21	1,05	1,41	1,15	1,11	1,14	1,43		1,18	1,31
		medium	1,13	1,05	1,07	1,15	1,05	1,41	1,10	1,11	1,14	1,13		1,08	1,13
		high	1,12	1,04	1,05	1,06	1,02	1,41	1,04	1,11	1,14	1,04		0,98	1,06
	consideration in "common"		1	1	1	1	1	1	1	1	1	1			n=10
B_WP	wood-pellets boiler	poor	1,34		1,33	1,37		2,62			1,44	1,59	1,25	2,00	2,12
		medium	1,34		1,33	1,31		2,62			1,42	1,31	1,25	1,60	1,52
		high	1,34		1,33	1,25		2,62			1,40	1,18	1,25	1,20	1,31
	consideration in "common"		1		1	1		1			1	1	1	1	n=8
G_IWH_NC	gas-fired instantaneous water heater, non-condensing	poor				1,27			1,25						1,27
		medium				1,23			1,25						1,24
		high				1,18			1,25						1,20
	consideration in "common"					1			1						n=2
G_IWH_C	gas-fired instantaneous water heater, condensing	poor				1,18			1,12						1,17
		medium				1,14			1,12						1,13
		high				1,09			1,12						1,10
	consideration in "common"					1			1						n=2
G_SH	gas-fired space heater	poor	1,59			1,40			1,46					1,18	1,50
		medium	1,59			1,40			1,46					1,18	1,41
		high	1,59			1,40			1,46					1,18	1,29
	consideration in "common"		1			1			1					1	n=4
E_Immersion	electric immersion heater	poor				1,00			1,11				1,02		1,08
		medium				1,00			1,06				1,02		1,03
		high				1,00			1,00				1,02		1,00
	consideration in "common"					1			1				1		n=3
E	direct electric heat generator	poor	1,01	1,00	1,00	1,00	1,00	1,45	1,05	1,00		1,05	1,00		1,25
		medium	1,01	1,00	1,00	1,00	1,00	1,16	0,93	1,00		1,02	1,00		1,02
		high	1,01	1,00	1,00	1,00	1,00	1,06	0,28	1,00		1,00	1,00		1,00
	consideration in "common"		1	1	1	1	1	1		1		1	1		n=9
HP_Air	heat pump, heat source external air	poor	0,29	0,37	0,42	0,45	0,29	0,45	0,59	0,38	0,40		0,40	0,36	0,50
		medium	0,29	0,37	0,39	0,40	0,29	0,45	0,44	0,32	0,40		0,40	0,36	0,37
		high	0,29	0,37	0,35	0,35	0,29	0,45	0,29	0,26	0,40		0,40	0,36	0,30
	consideration in "common"		1	1	1	1	1	1	1	1	1		1	1	n=11
HP_Ground	heat pump, heat source ground	poor	0,25	0,70	0,32	0,36	0,25	0,29	0,19	0,36	0,33	0,29	0,33	0,29	0,52
		medium	0,25	0,47	0,31	0,32	0,25	0,29	0,17	0,36	0,33	0,29	0,33	0,29	0,31
		high	0,25	0,26	0,29	0,29	0,25	0,29	0,14	0,36	0,33	0,29	0,33	0,29	0,21
	consideration in "common"		1	1	1	1	1	1	1	1	1	1	1	1	n=12
HP_ExhAir	heat pump, heat source exhaust air	poor							0,29			0,38	0,33		0,36
		medium							0,29			0,38	0,33		0,33
		high							0,29			0,38	0,33		0,31
	consideration in "common"								1			1	1		n=3
Stove	stove	poor	2,22	1,81		1,60		3,76	1,57		2,50	1,67			2,96
		medium	1,74	1,51		1,50		3,76	1,35		2,14	1,47			1,92
		high	1,52	1,34		1,40		3,76	1,07		1,79	1,19			1,40
	consideration in "common"		1	1		1		1	1		1	1			n=7
OpenFire	open fire	poor							5,00	3,33		3,33			4,44
		medium							3,50	3,33		3,33			3,39
		high							2,00	3,33		3,33			2,44
	consideration in "common"								1	1		1			n=3
TS	district heating transfer station	poor	1,02		1,05	1,02	1,06	1,53	1,25		1,09	1,08	1,33	1,00	1,34
		medium	1,02		1,04	1,02	1,05	1,53	1,15		1,09	1,05	1,33	1,00	1,13
		high	1,02		1,02	1,02	1,03	1,53	1,05		1,09	1,01	1,33	1,00	1,06
	consideration in "common"		1		1	1	1	1	1		1	1	1	1	n=10
CHP	combined heat and power generation	poor			1,67	1,67			1,30						1,67
		medium			1,67	1,67			1,24						1,67
		high			1,67	1,67			1,18						1,67
	consideration in "common"				1	1									n=2
Solar	thermal solar plant	poor	0,00			0,00	0,00		0,00		0,00		0,00	0,00	0,00
		medium	0,00			0,00	0,00		0,00		0,00		0,00	0,00	0,00
		high	0,00			0,00	0,00		0,00		0,00		0,00	0,00	0,00
	consideration in "common"		1			1	1		1		1		1	1	n=7

Energy expenditure factor electricity (CHP)

CHP	combined heat and power generation	poor	-	-	3,33	3,33	-	-	0,00	-	-	-	-	-	3,33
		medium	-	-	3,33	3,33	-	-	0,00	-	-	-	-	-	3,33
		high	-	-	3,33	3,33	-	-	0,00	-	-	-	-	-	3,33
	consideration in "common"				1	1									n=2

Remarks

Merging of subdivisions of heat generators

B_NC: includes values of: B_NC, B_NC_CT, B_NC_LT

E: includes values of: E, E_Storage, E_Underfloor, E_SH

Stove: includes values of: Stove, Stove_L, Stove_S

Determination of common values

B_C: SI: not considered / values are unrealistic low (referring to H_i instead of H_S?)

E: GR: not considered / values are unrealistic low (including heat pump systems?)

Figure 11: **Heat generation expenditure factors of heating systems (1)**
boilers: <B_NC> non-condensing, <B_C> condensing, <B_WP> wood-pellets

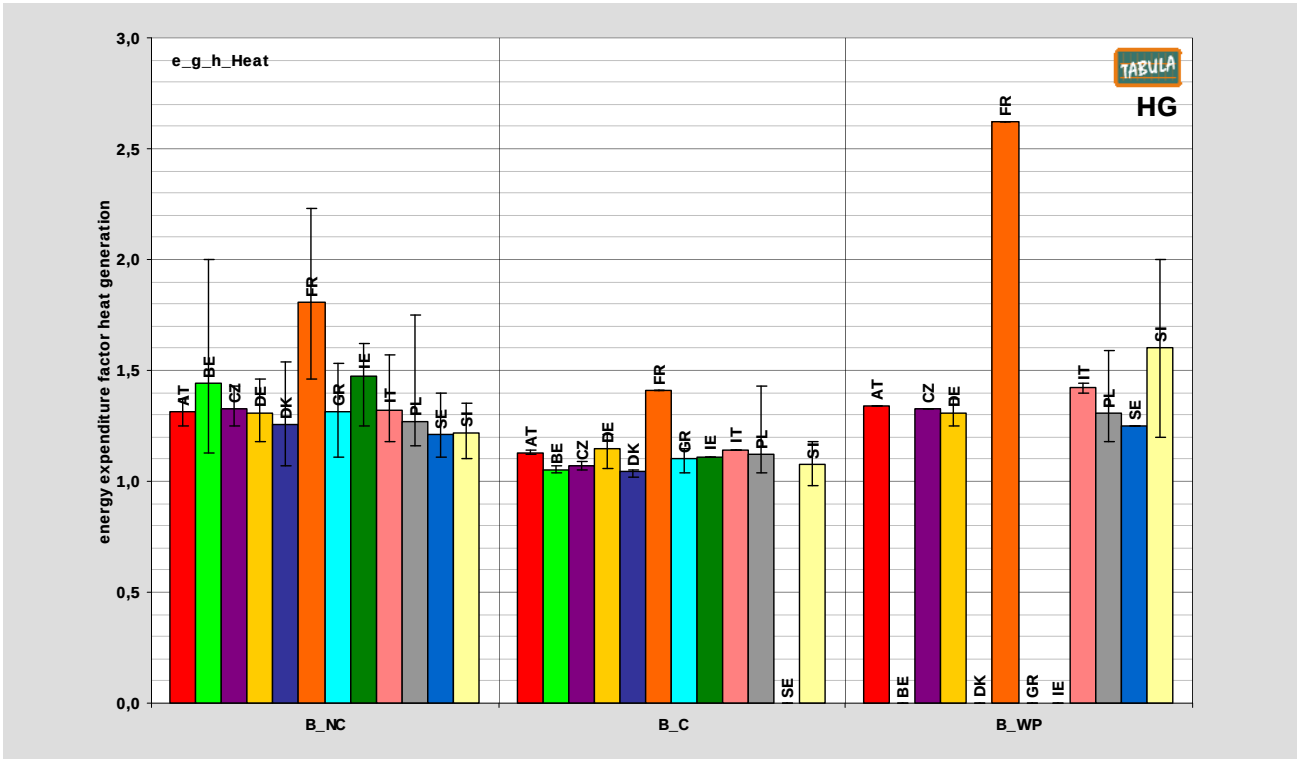


Figure 12: **Heat generation expenditure factors of heating systems (2)**
electrical heat pumps, heat sources: <HP_Air> external air, <HP_Ground> ground, <HP_ExhAir> exhaust air

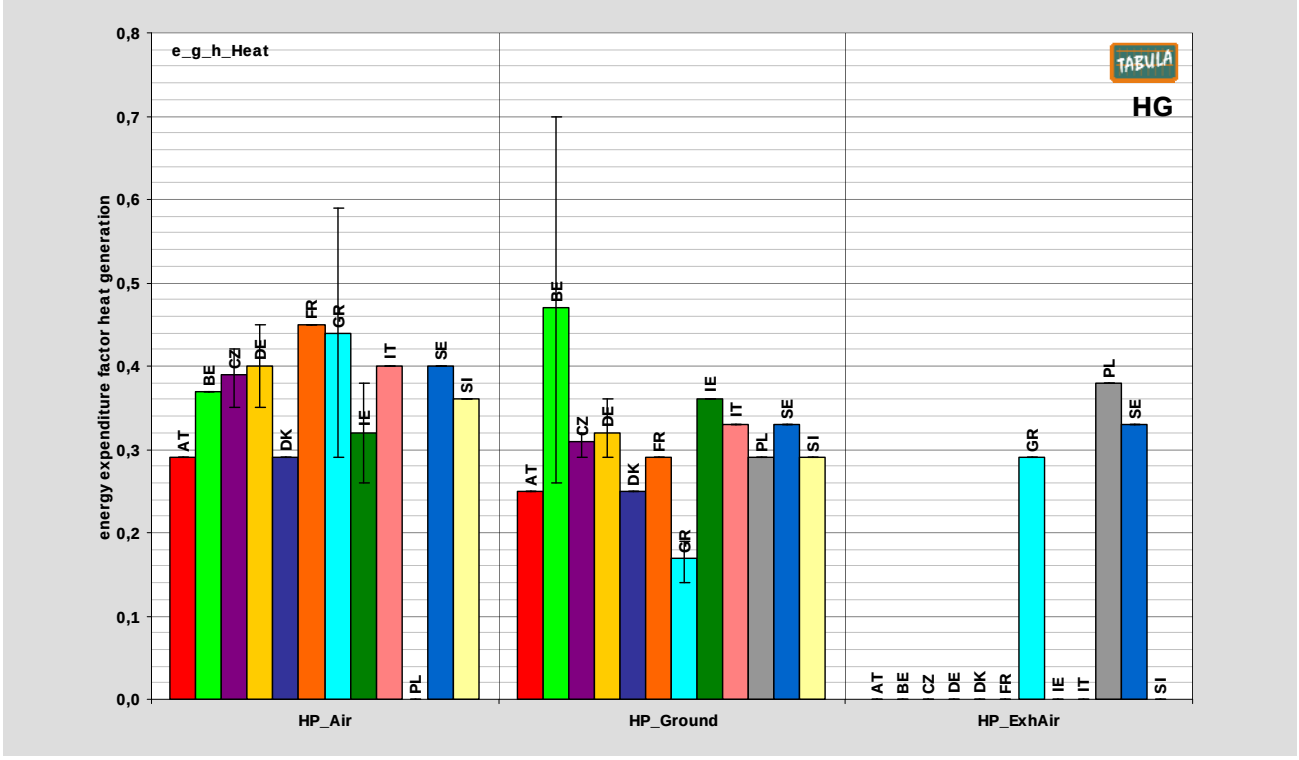


Figure 13: Heat generation expenditure factors of heating systems (3)

gas-fired instantaneous water heaters: <G_IWH_NC> non-condensing, <G_IWH_C> condensing; <G_SH> gas-fired space heater; <Stoves> stoves; <OpenFire> open fires; <TS> district heating transfer station

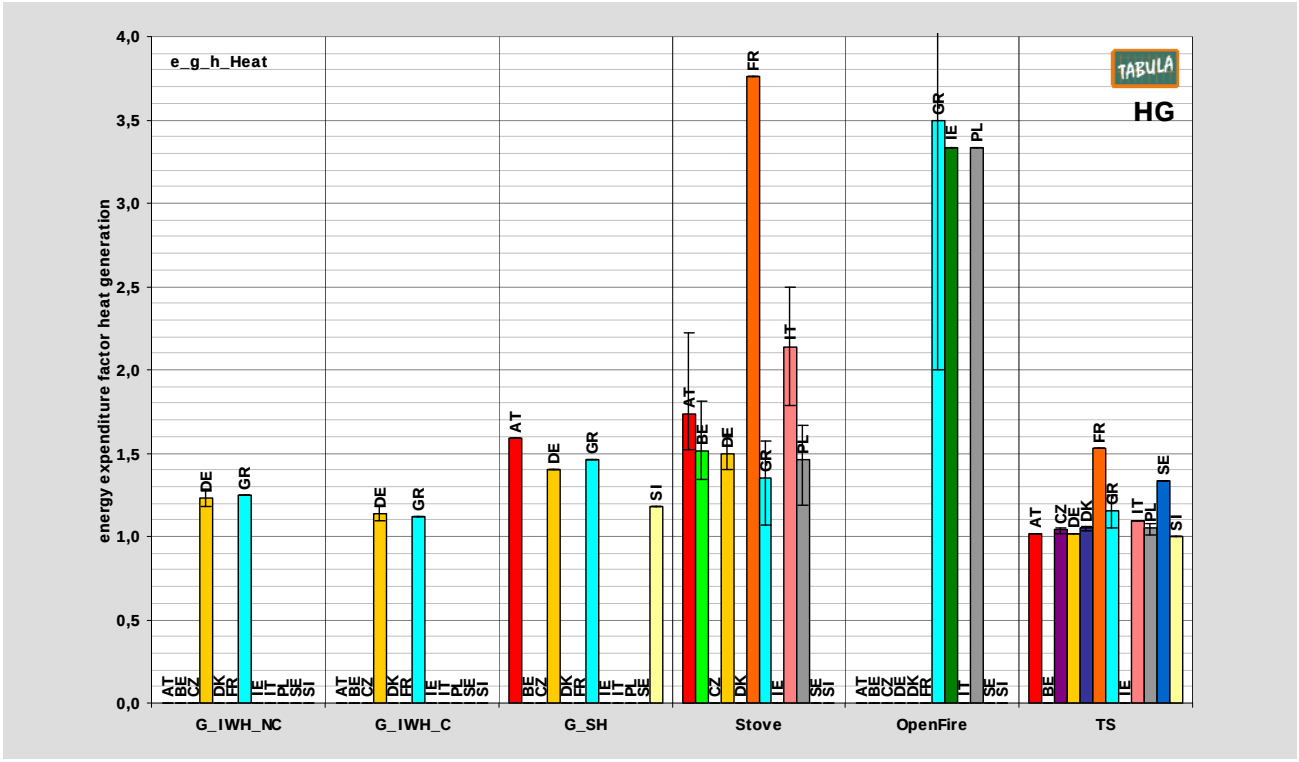


Table 14: Heat generation of heating systems / derived default values (simplified common values)

TABULA Code	Description	heat generation expenditure factor (heating systems)			electricity generation expenditure factor (heating systems)		
		delivered energy demand (H_S) devided by produced heat			electricity demand devided by produced heat		
		$e_{g,h}$			$e_{g,el,h}$		
		[-]			[-]		
	energy efficiency	**poor**	**medium**	**high**	**poor**	**medium**	**high**
B_NC	boiler, non-condensing	1,92	1,36	1,13	-	-	-
B_C	boiler, condensing	1,31	1,13	1,06	-	-	-
B_WP	wood-pellets boiler	2,12	1,52	1,31	-	-	-
G_IWH_NC	gas-fired instantaneous water heater, non-condensing	1,27	1,24	1,20	-	-	-
G_IWH_C	gas-fired instantaneous water heater, condensing	1,17	1,13	1,10	-	-	-
G_SH	gas-fired space heater	1,50	1,41	1,29	-	-	-
E_Immersion	electric immersion heater	1,08	1,03	1,00	-	-	-
E	direct electric heat generator	1,25	1,02	1,00	-	-	-
HP_Air	heat pump, heat source external air	0,50	0,37	0,30	-	-	-
HP_Ground	heat pump, heat source ground	0,52	0,31	0,21	-	-	-
HP_ExhAir	heat pump, heat source exhaust air	0,36	0,33	0,31	-	-	-
Stove	stove	2,96	1,92	1,40	-	-	-
OpenFire	open fire	4,44	3,39	2,44	-	-	-
TS	district heating transfer station	1,34	1,13	1,06	-	-	-
CHP	combined heat and power generation	1,67	1,67	1,67	3,33	3,33	3,33
Solar	thermal solar plant	0,00	0,00	0,00	-	-	-

4.3 HS – Heating Systems / Heat Storage

Table 15: Annual heat loss of the space heating storage differentiated by country and by building size class

			AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common	deviation
BS	SUH	min	-	-	-	-	2,0	-	2,5	-	1,4	3,0	2,5	2,0	2,1	-68%
		average	-	-	-	-	3,6	-	2,5	-	4,2	6,9	17,3	5,3	6,6	
		max	-	-	-	-	6,4	-	2,5	-	7,5	12,0	28,8	8,5	13,5	+104%
	MUH	min	-	-	-	-	0,3	-	2,5	-	0,8	3,0	0,1	2,0	1,3	-59%
		average	-	-	-	-	0,7	-	2,5	-	3,1	6,9	0,1	5,3	3,1	-54%
		max	-	-	-	-	1,3	-	2,5	-	6,6	12,0	0,1	8,5	6,1	+99%
	deviation from "common"						-56%		-48%		-24%	+42%	+79%	+8%		
BS_E	SUH	min	7,1	5,6	9,5	4,5	-	0,0	1,8	-	-	-	-	-	4,07	-23%
		average	7,5	7,2	10,3	5,2	-	0,0	1,8	-	-	-	-	-	5,32	
		max	7,8	8,8	11,0	5,9	-	0,0	1,8	-	-	-	-	-	6,61	+24%
	MUH	min	7,1	5,6	9,5	4,5	-	0,0	1,8	-	-	-	-	-	4,07	-23%
		average	7,5	7,2	10,3	5,2	-	0,0	1,8	-	-	-	-	-	5,32	0%
		max	7,8	8,8	11,0	5,9	-	0,0	1,8	-	-	-	-	-	6,61	+24%
	deviation from "common"		+40%	+35%	+93%	-2%		-100%	-66%							
BS_Wood	SUH	min	7,1	10,1	7,9	7,2	-	-	1,8	-	-	-	7,0	-	6,13	-32%
		average	10,6	12,4	10,1	9,2	-	-	1,8	-	-	-	10,1	-	9,00	
		max	20,0	14,6	12,2	11,1	-	-	1,8	-	-	-	14,1	-	13,40	+49%
	MUH	min	7,1	10,1	7,9	7,2	-	-	1,8	-	-	-	-	-	5,98	-32%
		average	10,6	12,4	10,1	9,2	-	-	1,8	-	-	-	-	-	8,79	-2%
		max	20,0	14,6	12,2	11,1	-	-	1,8	-	-	-	-	-	13,28	+51%
	deviation from "common"		+19%	+39%	+13%	+3%			-80%							
Other	SUH	min	-	-	-	-	-	-	1,8	-	-	-	-	-	1,80	0%
		average	-	-	-	-	-	-	1,8	-	-	-	-	-	1,80	
		max	-	-	-	-	-	-	1,8	-	-	-	-	-	1,80	0%
	MUH	min	-	-	-	-	-	-	1,8	-	-	-	-	-	1,80	0%
		average	-	-	-	-	-	-	1,8	-	-	-	-	-	1,80	0%
		max	-	-	-	-	-	-	1,8	-	-	-	-	-	1,80	0%
	deviation from "common"								0%							

Table 16: Deviations from averages ("common values") per country

	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI
BS					-56%		-48%		-24%	+42%	+79%	+8%
BS_E	+40%	+35%	+93%	-2%		-100%	-66%					
BS_Wood	+19%	+39%	+13%	+3%			-80%					
Other							0%					

Table 17: Annual heat loss of the space heating storage / merged and condensed values

heat storage type		energy efficiency	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common
BS	buffer storage	poor	13,9	11,7	11,6	8,5	6,4	0,0	2,0		7,5	12,0	21,5	8,5	15,9
		medium	9,0	9,8	10,2	7,2	2,1	0,0	2,0		3,7	6,9	9,4	5,3	6,5
		high	7,1	7,9	8,7	5,9	0,3	0,0	2,0		0,8	3,0	3,6	2,0	2,2
	consideration in "common"		1	1	1	1	1		1		1	1	1	1	n=10

Figure 14: **Annual storage heat losses of heating systems**
<BS> buffer storages

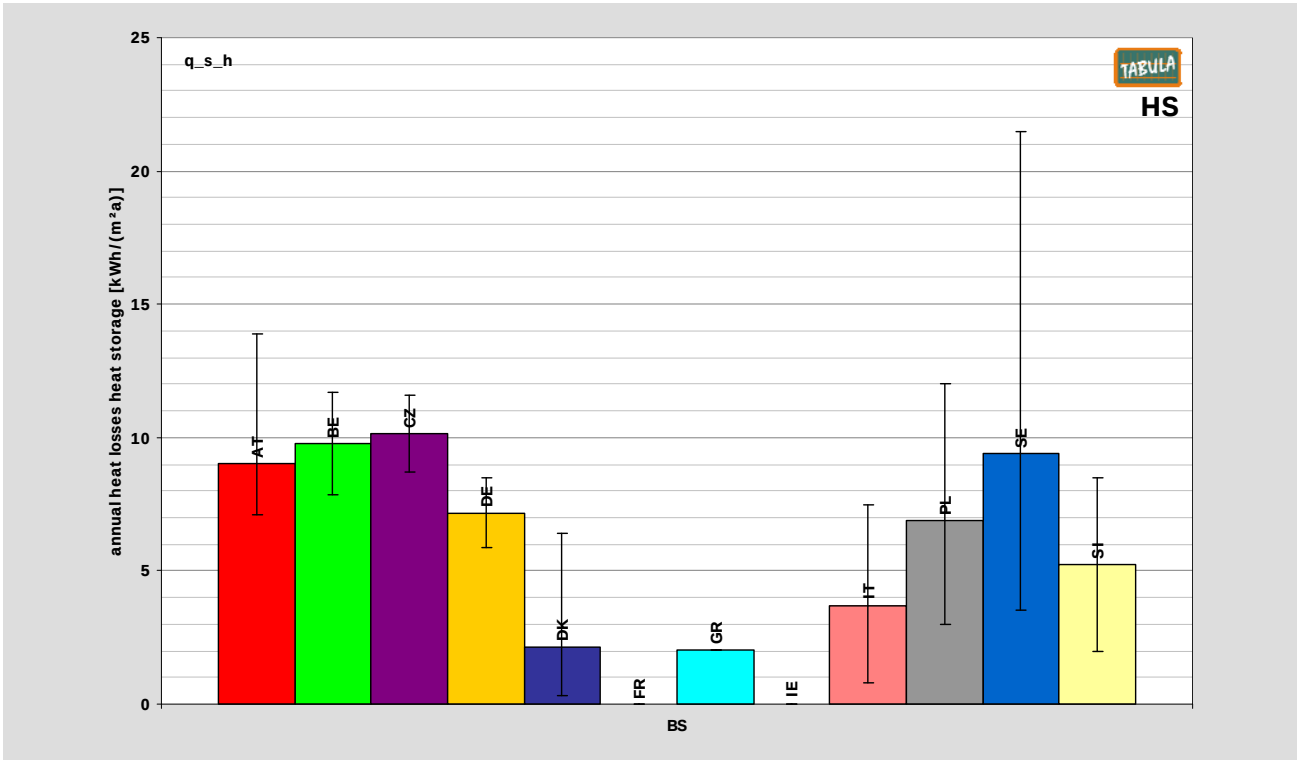


Table 18: **Annual heat loss of the space heating storage / derived default values (simplified common values)**

TABULA code	description	heat loss of the space heating storage		
		annual heat losses during heating season per m² reference area		
		$q_{s,h}$		
		[kWh/(m²a)]		
	energy efficiency	poor	medium	high
-	no heat storage	0,0	0,0	0,0
BS	buffer storage	15,9	6,5	2,2

4.4 HD – Heating Systems / Heat Distribution

Table 19: Annual heat loss of the space heating distribution differentiated by country and by building size class

			AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common	deviation
D	SUH	min	0,0	0,0	-	0,0	-	0,0	0,0	-	-	0,0	0,0	0,0	0,0	
		average	0,0	0,0	-	0,0	-	0,0	0,0	-	-	0,0	0,0	0,0	0,0	
		max	0,0	0,0	-	0,0	-	0,0	0,0	-	-	0,0	0,0	0,0	0,0	
	MUH	min	0,0	0,0	-	0,0	-	0,0	0,0	0,0	-	0,0	0,0	0,0	0,0	
		average	0,0	0,0	-	0,0	-	0,0	0,0	0,0	-	0,0	0,0	0,0	0,0	
		max	0,0	0,0	-	0,0	-	0,0	0,0	0,0	-	0,0	0,0	0,0	0,0	
	deviation from "common"															
C	SUH	min	-	-	-	-	-	-	1,8	-	-	-	-	4,0	2,53	-60%
		average	-	-	-	-	-	-	3,4	-	-	-	-	9,3	6,37	
		max	-	-	-	-	-	-	5,0	-	-	-	-	14,0	11,00	+73%
	MUH	min	-	-	-	-	-	-	1,8	-	-	-	-	4,0	2,53	-60%
		average	-	-	-	-	-	-	3,4	-	-	-	-	9,3	6,37	0%
		max	-	-	-	-	-	-	5,0	-	-	-	-	14,0	11,00	+73%
	deviation from "common"								-47%					+47%		
C_Int	SUH	min	10,0	0,0	7,0	6,2	0,0	0,0	0,5	0,0	1,6	12,0	0,0	-	3,11	-53%
		average	20,0	0,0	7,0	6,2	0,0	0,0	3,3	9,5	14,2	12,0	0,0	-	6,56	
		max	30,0	0,0	7,0	6,2	0,0	0,0	6,2	20,1	32,1	12,0	0,0	-	12,14	+85%
	MUH	min	10,0	0,0	7,0	6,2	0,0	0,0	0,5	0,0	-	12,0	0,0	-	3,25	-37%
		average	20,0	0,0	7,0	6,2	0,0	0,0	3,3	2,6	-	12,0	0,0	-	5,11	-22%
		max	30,0	0,0	7,0	6,2	0,0	0,0	6,2	5,2	-	12,0	0,0	-	8,78	+72%
	deviation from "common"		+243%	-100%	+20%	+6%	-100%	-100%	-43%	+3%		+106%	-100%			
C_Ext	SUH	min	7,0	5,1	8,5	10,7	1,7	0,0	0,8	-	3,5	16,2	-	-	5,35	-59%
		average	7,0	11,1	18,7	21,7	7,5	0,0	9,0	-	23,8	19,9	-	-	13,17	
		max	7,0	17,0	33,0	31,7	22,1	0,0	22,6	-	53,1	23,5	-	-	26,31	+100%
	MUH	min	7,0	3,8	8,5	5,7	0,7	0,0	0,8	-	2,0	16,2	-	-	4,47	-59%
		average	7,0	8,3	18,7	15,6	3,0	0,0	9,0	-	15,6	19,9	-	-	10,79	-18%
		max	7,0	12,8	33,0	22,0	4,2	0,0	22,6	-	35,1	23,5	-	-	19,53	+81%
	deviation from "common"		-42%	-19%	+56%	+56%	-56%	-100%	-25%		+64%	+66%				
A	SUH	min	-	-	-	-	-	-	-	-	-	-	-	-	-	
		average	-	-	-	-	-	-	-	-	-	-	-	-	-	
		max	-	-	-	-	-	-	-	-	-	-	-	-	-	
	MUH	min	-	-	-	-	-	-	1,0	-	1,0	-	-	-	1,00	-83%
		average	-	-	-	-	-	-	1,8	-	9,7	-	-	-	5,72	
		max	-	-	-	-	-	-	2,5	-	22,4	-	-	-	15,77	+176%
	deviation from "common"															
Air_Int	SUH	min	-	-	-	-	-	-	1,9	-	-	-	-	-	1,90	-45%
		average	-	-	-	-	-	-	3,5	-	-	-	-	-	3,45	
		max	-	-	-	-	-	-	5,0	-	-	-	-	-	5,00	+45%
	MUH	min	-	-	-	-	-	-	-	-	-	-	-	-	-	
		average	-	-	-	-	-	-	-	-	-	-	-	-	-	
		max	-	-	-	-	-	-	-	-	-	-	-	-	-	
	deviation from "common"															
Air_Ext	SUH	min	-	-	-	-	-	-	4,2	-	-	-	-	-	4,20	-28%
		average	-	-	-	-	-	-	5,8	-	-	-	-	-	5,80	
		max	-	-	-	-	-	-	7,4	-	-	-	-	-	7,40	+28%
	MUH	min	-	-	-	-	-	-	-	-	-	-	-	-	-	
		average	-	-	-	-	-	-	-	-	-	-	-	-	-	
		max	-	-	-	-	-	-	-	-	-	-	-	-	-	
	deviation from "common"															
MV_SupExh_Ext	SUH	min	-	-	-	-	-	-	2,9	-	-	-	-	-	2,90	-28%
		average	-	-	-	-	-	-	4,1	-	-	-	-	-	4,05	
		max	-	-	-	-	-	-	5,2	-	-	-	-	-	5,20	+28%
	MUH	min	-	-	-	-	-	-	-	-	-	-	-	-	-	
		average	-	-	-	-	-	-	-	-	-	-	-	-	-	
		max	-	-	-	-	-	-	-	-	-	-	-	-	-	
	deviation from "common"															
MV_SupExh_Int	SUH	min	-	-	-	-	-	-	1,3	-	-	-	-	-	1,30	-46%
		average	-	-	-	-	-	-	2,4	-	-	-	-	-	2,40	
		max	-	-	-	-	-	-	3,5	-	-	-	-	-	3,50	+46%
	MUH	min	-	-	-	-	-	-	-	-	-	-	-	-	-	
		average	-	-	-	-	-	-	-	-	-	-	-	-	-	
		max	-	-	-	-	-	-	-	-	-	-	-	-	-	
	deviation from "common"															
MV_SupExh_Int	SUH	min	-	-	-	-	-	-	1,3	-	-	-	-	-	1,30	-46%
		average	-	-	-	-	-	-	2,4	-	-	-	-	-	2,40	
		max	-	-	-	-	-	-	3,5	-	-	-	-	-	3,50	+46%
	MUH	min	-	-	-	-	-	-	-	-	-	-	-	-	-	
		average	-	-	-	-	-	-	-	-	-	-	-	-	-	
		max	-	-	-	-	-	-	-	-	-	-	-	-	-	
	deviation from "common"															

Table 20: Deviations from averages ("common values") per country

	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI
D												
C							-47%					+47%
C_Int	+243%	-100%	+20%	+6%	-100%	-100%	-43%	+3%		+106%	-100%	
C_Ext	-42%	-19%	+56%	+56%	-56%	-100%	-25%		+64%	+66%		
A												
Air_Int												
Air_Ext												
MV_SupExh_Ext												
MV_SupExh_Int												
MV_SupExh_Int												

Table 21: Annual heat loss of the space heating distribution / merged and condensed values

heat distribution type		energy efficiency	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common
D	decentral system	poor	0,0	0,0		0,0		0,0	0,0	0,0		0,0	0,0	0,0	0,0
		medium	0,0	0,0		0,0		0,0	0,0	0,0		0,0	0,0	0,0	0,0
		high	0,0	0,0		0,0		0,0	0,0	0,0		0,0	0,0	0,0	0,0
	consideration in "common"		1	1		1		1	1	1		1	1	1	n=9
C_Int	central heating, all pipes inside of thermal envelope	poor	30,0	0,0	7,0	6,2	0,0	0,0	6,2	20,1	32,1	12,0	0,0	14,0	21,4
		medium	20,0	0,0	7,0	6,2	0,0	0,0	3,3	6,0	14,2	12,0	0,0	9,3	6,5
		high	10,0	0,0	7,0	6,2	0,0	0,0	0,5	0,0	1,6	12,0	0,0	4,0	1,7
	consideration in "common"		1	1	1	1	1	1	1	1	1	1	1	1	n=12
C_Ext	central heating, fraction of pipeline outside of thermal envelope	poor	7,0	17,0	33,0	31,7	22,1	0,0	22,6		53,1	23,5		14,0	39,0
		medium	7,0	9,7	18,7	18,6	5,3	0,0	9,0		19,7	19,9		9,3	13,0
		high	7,0	3,8	8,5	5,7	0,7	0,0	0,8		2,0	16,2		4,0	3,1
	consideration in "common"		1	1	1	1	1		1		1	1		1	n=9

Remarks

Determination of common values

C_Ext FR: not considered / 0 kWh/(m²a) is not plausible

Figure 15: Annual distribution heat losses of heating systems /

central heating: <C_Int> all pipes inside of thermal envelope; <C_Ext> fraction of pipeline outside of thermal envelope

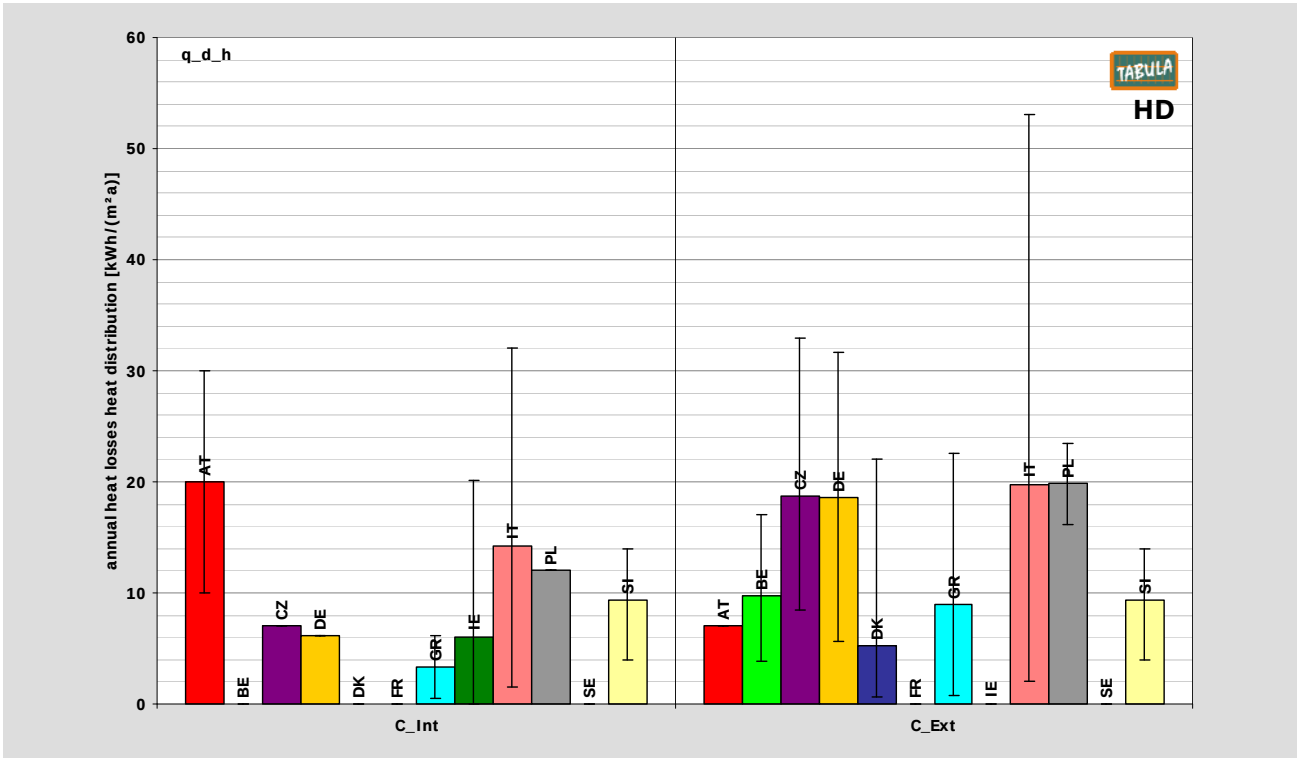


Table 22: Annual heat loss of the space heating distribution / derived default values (simplified common values)

TABULA code	description	heat loss of the space heating distribution		
		annual heat losses during heating season per m² reference area		
		$q_{d,h}$		
		[kWh/(m²a)]		
	energy efficiency	poor	medium	high
D	decentral system	0,0	0,0	0,0
C_Int	central heating, all pipes inside of thermal envelope	21,4	6,5	1,7
C_Ext	central heating, fraction of pipeline outside of thermal envelope	39,0	13,0	3,1

4.5 HA – Heating Systems / Auxiliary Energy

Table 23: Annual auxiliary electricity demand of space heating systems differentiated by country and by building size class

			AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common	deviation
D	SUH	min	-	0,0	-	0,0	-	0,0	0,0	-	-	0,0	-	0,0	0,0	
		average	-	0,0	-	0,0	-	0,0	0,0	-	-	0,0	-	0,0	0,0	
		max	-	0,0	-	0,0	-	0,0	0,0	-	-	0,0	-	0,0	0,0	
	MUH	min	-	0,0	-	0,0	-	0,0	0,0	-	1,6	0,0	-	0,0	0,2	-57%
		average	-	0,0	-	0,0	-	0,0	0,0	-	3,3	0,0	-	0,0	0,5	
		max	-	0,0	-	0,0	-	0,0	0,0	-	4,9	0,0	-	0,0	1,2	+164%
	deviation from "common"			-100%		-100%		-100%	-100%			-100%		-100%		
C	SUH	min	0,0	1,1	0,5	6,1	3,2	0,0	0,0	1,4	2,7	6,2	1,6	2,7	1,96	-44%
		average	3,4	2,8	4,3	6,1	4,3	0,0	2,3	2,0	3,8	6,2	4,5	2,7	3,52	
		max	6,7	4,8	8,0	6,1	5,5	0,0	5,5	2,6	4,4	6,2	8,1	2,7	5,28	+50%
	MUH	min	0,0	1,1	0,5	1,8	5,5	0,0	0,0	1,8	1,6	6,2	5,3	2,7	2,04	-34%
		average	1,0	2,8	1,8	1,8	5,5	0,0	2,3	1,8	2,1	6,2	8,9	2,7	3,07	-13%
		max	2,0	4,8	3,0	1,8	5,5	0,0	5,5	1,8	2,6	6,2	12,0	2,7	4,61	+50%
	deviation from "common"		-34%	-16%	-9%	+20%	+49%	-100%	-30%	-43%	-10%	+88%	+103%	-18%		

Table 24: Deviations from averages ("common values") per country

	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI
D		-100%		-100%		-100%	-100%			-100%		-100%
C	-34%	-16%	-9%	+20%	+49%	-100%	-30%	-43%	-10%	+88%	+103%	-18%

Table 25: Annual auxiliary electricity demand of space heating systems / merged and condensed values

heat generator type		energy efficiency	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common
D	decentral system, no distribution ducts available	poor		0,0		0,0		0,0	0,0		4,9	0,0		0,0	2,8
		medium		0,0		0,0		0,0	0,0		3,3	0,0		0,0	0,5
		high		0,0		0,0		0,0	0,0		1,6	0,0		0,0	0,1
	consideration in "common"			1		1		1	1		1	1		1	n=7
C	central heating, distribution by pipeline	poor	6,7	4,8	8,0	6,1	5,5	0,0	5,5	2,6	4,4	6,2	12,0	2,7	8,9
		medium	2,2	2,8	3,0	4,0	4,9	0,0	2,3	1,9	3,0	6,2	6,7	2,7	3,6
		high	0,0	1,1	0,5	1,8	3,2	0,0	0,0	1,4	1,6	6,2	1,6	2,7	0,9
	consideration in "common"		1	1	1	1	1		1	1	1	1	1	1	n=11

Remarks

Determination of common values

D IT: not considered (central heating system per apartment; here the category "D" would be interpreted as a system without pump)

C FR: not considered / 0 kWh/(m²a) is not plausible

Figure 16: **Annual auxiliary electricity demand of space heating systems /**
<C> central heating systems

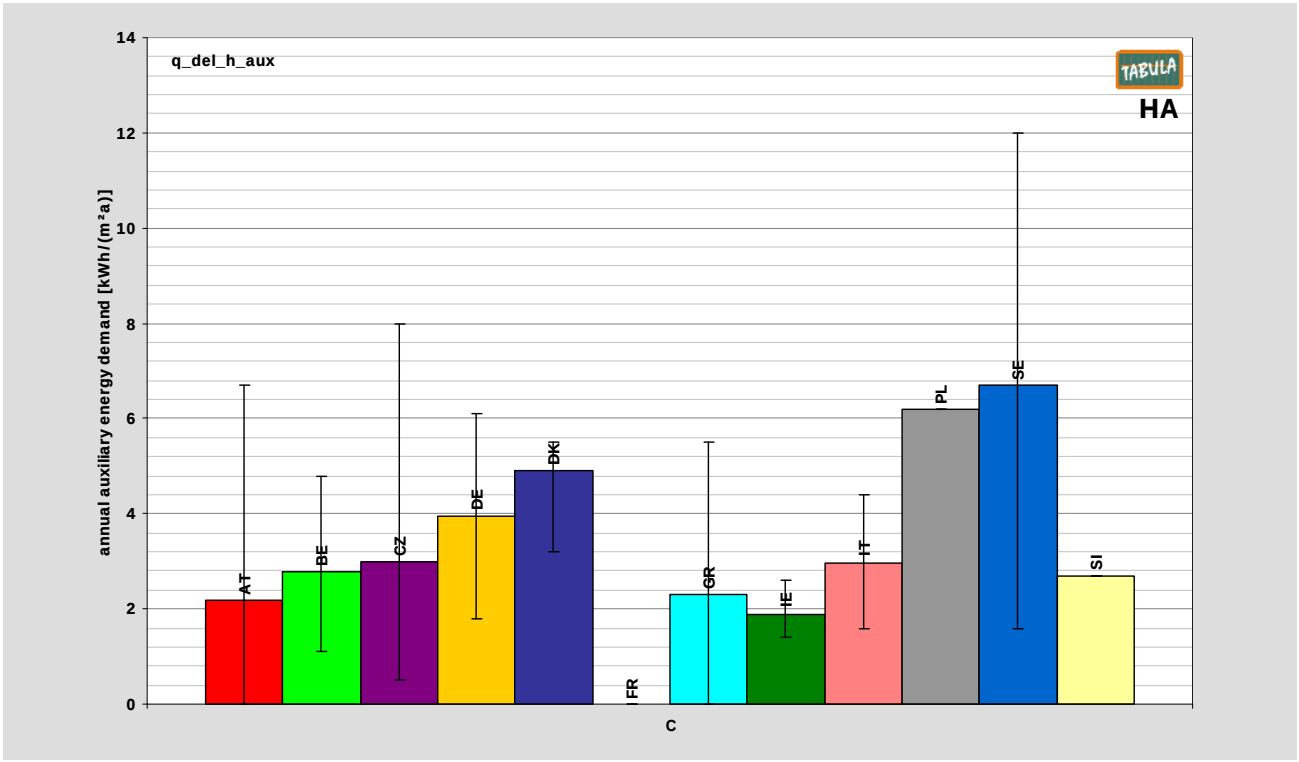


Table 26: **Annual auxiliary electricity demand of space heating systems / derived default values (simplified common values)**

TABULA code	description	auxiliary energy demand (electricity) of heating systems		
		annual values in kWh per m² reference area for heat generation (blower, control), storage (pump), distribution (pump) and heat emission (fan), as far as available		
		$q_{del,h,aux}$		
		[kWh/(m²a)]		
	energy efficiency	**poor**	**medium**	**high**
D	decentral system, no distribution ducts available	0,0	0,0	0,0
C	central heating, distribution by pipeline	8,9	3,6	0,9

4.6 WG – Domestic Hot Water Systems / Heat Generation

Table 27: Energy expenditure factors heat generation (heating systems) differentiated by country and by building size class

			AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common	deviation
B	SUH	min	1,33	-	-	-	-	-	1,26	-	-	-	-	-	1,28	-12%
		average	1,53	-	-	-	-	-	1,39	-	-	-	-	-	1,46	
		max	1,67	-	-	-	-	-	1,64	-	-	-	-	-	1,66	+14%
	MUH	min	1,33	-	-	-	-	-	1,26	-	-	-	-	-	1,28	-12%
		average	1,53	-	-	-	-	-	1,39	-	-	-	-	-	1,46	0%
		max	1,67	-	-	-	-	-	1,64	-	-	-	-	-	1,66	+14%
	deviation from "common"		+5%						-5%							
B_NC	SUH	min	1,25	1,31	-	-	1,07	-	1,53	-	1,24	-	1,11	1,35	1,24	-7%
		average	1,41	1,36	-	-	1,12	-	1,53	-	1,36	-	1,23	1,35	1,34	
		max	1,53	1,47	-	-	1,16	-	1,53	-	1,48	-	1,4	1,35	1,43	+7%
	MUH	min	1,25	1,28	-	-	-	-	1,53	-	1,17	-	1,11	1,35	1,26	-8%
		average	1,41	1,36	-	-	-	-	1,53	-	1,31	-	1,23	1,35	1,37	+2%
		max	1,53	1,44	-	-	-	-	1,53	-	1,53	-	1,4	1,35	1,47	+8%
	deviation from "common"		+4%	+1%					+13%		-1%		-9%	-0%		
B_NC_CT	SUH	min	1,3	1,85	1,47	1,63	1,07	1,84	1,14	1,25	-	1,54	-	1,2	1,40	-11%
		average	1,47	1,85	1,5	1,7	1,3	2,39	1,29	1,44	-	1,54	-	1,2	1,57	
		max	1,59	1,85	1,54	1,76	1,54	3,27	1,5	1,62	-	1,54	-	1,2	1,88	+20%
	MUH	min	1,3	1,48	1,47	1,32	1,14	1,98	1,14	1,4	-	1,54	-	1,2	1,37	-9%
		average	1,47	1,52	1,5	1,38	1,34	2,31	1,29	1,51	-	1,54	-	1,2	1,51	-4%
		max	1,59	1,56	1,54	1,43	1,54	3,16	1,5	1,62	-	1,54	-	1,2	1,80	+20%
	deviation from "common"		-4%	+10%	-2%	+0%	-14%	+53%	-16%	-4%		+0%		-22%		
B_NC_LT	SUH	min	1,14	-	1,33	1,27	-	1,57	1,09	-	-	1,16	-	1,1	1,22	-6%
		average	1,16	-	1,38	1,33	-	1,77	1,14	-	-	1,16	-	1,1	1,29	
		max	1,18	-	1,43	1,38	-	1,96	1,19	-	-	1,16	-	1,1	1,42	+10%
	MUH	min	1,14	-	1,33	1,2	-	1,57	1,09	-	-	1,11	-	1,1	1,20	-5%
		average	1,16	-	1,38	1,25	-	1,77	1,14	-	-	1,11	-	1,1	1,27	-1%
		max	1,18	-	1,43	1,29	-	1,96	1,19	-	-	1,11	-	1,1	1,40	+10%
	deviation from "common"		-10%		+8%	+1%		+38%	-11%			-11%		-14%		
B_C	SUH	min	1,03	1,17	1,18	1,21	1,02	1,51	1,02	1,11	1,12	1,1	-	0,98	1,12	-5%
		average	1,04	1,17	1,26	1,26	1,04	1,7	1,09	1,11	1,12	1,1	-	1,08	1,18	
		max	1,06	1,17	1,32	1,31	1,05	1,89	1,15	1,11	1,12	1,1	-	1,18	1,28	+8%
	MUH	min	1,03	-	1,18	1,17	1,05	1,51	1,02	1,11	1,12	1,1	-	0,98	1,11	-5%
		average	1,04	-	1,26	1,2	1,05	1,7	1,09	1,11	1,12	1,13	-	1,08	1,18	-0%
		max	1,06	-	1,32	1,24	1,05	1,89	1,15	1,11	1,12	1,15	-	1,18	1,29	+9%
	deviation from "common"		-12%		+7%	+4%	-11%	+44%	-8%	-6%	-5%	-5%		-8%		
B_WP	SUH	min	1,34	-	1,33	1,63	-	3,44	-	-	-	-	1,25	1,2	1,63	-8%
		average	1,34	-	1,33	1,63	-	3,44	-	-	-	-	1,25	1,6	1,77	
		max	1,34	-	1,33	1,63	-	3,44	-	-	-	-	1,25	2	2,06	+17%
	MUH	min	1,34	-	1,33	1,32	-	-	-	-	-	-	1,25	1,2	1,27	-7%
		average	1,34	-	1,33	1,32	-	-	-	-	-	-	1,25	1,6	1,37	-22%
		max	1,34	-	1,33	1,32	-	-	-	-	-	-	1,25	2	1,54	+13%
	deviation from "common"		-14%		-15%	-6%							-20%	+2%		
G_IWH	SUH	min	1,13	-	-	-	-	-	1,27	-	-	1,82	-	1	1,24	-5%
		average	1,14	-	-	-	-	-	1,27	-	-	1,82	-	1	1,31	
		max	1,15	-	-	-	-	-	1,27	-	-	1,82	-	1	1,41	+8%
	MUH	min	1,13	-	-	-	-	-	1,27	-	-	1,82	-	1	1,24	-5%
		average	1,14	-	-	-	-	-	1,27	-	-	1,82	-	1	1,31	0%
		max	1,15	-	-	-	-	-	1,27	-	-	1,82	-	1	1,41	+8%
	deviation from "common"		-13%						-3%			+39%		-24%		
G_IWH_NC	SUH	min	-	1,31	1,31	1,31	-	-	1,25	-	1,39	1,19	-	1,18	1,27	-5%
		average	-	1,31	1,33	1,33	-	-	1,25	-	1,77	1,19	-	1,18	1,34	
		max	-	1,31	1,35	1,35	-	-	1,25	-	2,47	1,19	-	1,18	1,57	+18%
	MUH	min	-	1,31	1,31	1,31	-	-	1,25	-	1,39	1,19	-	1,18	1,27	-5%
		average	-	1,31	1,33	1,33	-	-	1,25	-	1,77	1,19	-	1,18	1,34	0%
		max	-	1,31	1,35	1,35	-	-	1,25	-	2,47	1,19	-	1,18	1,57	+18%
	deviation from "common"			-2%	-1%	-1%			-7%		+32%	-11%		-12%		
G_IWH_C	SUH	min	-	-	-	1,27	-	-	1,12	-	1,24	-	-	-	1,19	-2%
		average	-	-	-	1,29	-	-	1,12	-	1,24	-	-	-	1,22	
		max	-	-	-	1,31	-	-	1,12	-	1,24	-	-	-	1,25	+2%
	MUH	min	-	-	-	1,27	-	-	1,12	-	1,24	-	-	-	1,19	-2%
		average	-	-	-	1,29	-	-	1,12	-	1,24	-	-	-	1,22	0%
		max	-	-	-	1,31	-	-	1,12	-	1,24	-	-	-	1,25	+2%
	deviation from "common"					+6%			-8%		+2%					
G_Tank	SUH	min	-	-	1,34	1,34	-	-	1,22	-	-	-	-	1	1,18	-4%
		average	-	-	1,34	1,34	-	-	1,22	-	-	-	-	1	1,23	
		max	-	-	1,34	1,34	-	-	1,22	-	-	-	-	1	1,25	+2%
	MUH	min	-	-	1,34	1,34	-	-	1,22	-	-	-	-	1	1,18	-4%
		average	-	-	1,34	1,34	-	-	1,22	-	-	-	-	1	1,23	0%
		max	-	-	1,34	1,34	-	-	1,22	-	-	-	-	1	1,25	+2%
	deviation from "common"				+9%	+9%			-0%					-18%		

			AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common	deviation
E	SUH	min	1,01	1	-	-	1	-	1,03	-	1,33	-	-	1	1,05	-1%
		average	1,01	1	-	-	1	-	1,04	-	1,33	-	-	1	1,06	
		max	1,01	1	-	-	1	-	1,05	-	1,33	-	-	1	1,10	+4%
	MUH	min	1,01	1	-	-	-	-	1,03	-	1,33	-	-	1	1,06	-1%
		average	1,01	1	-	-	-	-	1,04	-	1,33	-	-	1	1,08	+1%
		max	1,01	1	-	-	-	-	1,05	-	1,33	-	-	1	1,12	+4%
	deviation from "common"		-6%	-7%					-3%		+24%			-7%		
E_Immersion	SUH	min	-	-	-	1	-	1,41	1	1	-	1	1,02	-	1,06	-3%
		average	-	-	-	1	-	1,5	1,06	1	-	1	1,02	-	1,10	
		max	-	-	-	1	-	1,59	1,11	1	-	1	1,02	-	1,19	+8%
	MUH	min	-	-	-	1	-	1,37	1	1	-	-	1,02	-	1,07	-5%
		average	-	-	-	1	-	1,53	1,06	1	-	-	1,02	-	1,12	+2%
		max	-	-	-	1	-	1,87	1,11	1	-	-	1,02	-	1,31	+17%
	deviation from "common"					-10%		+37%	-4%	-10%			-8%			
E_IWH	SUH	min	-	-	1	1	-	-	1	-	-	-	-	-	1,00	0%
		average	-	-	1	1	-	-	1	-	-	-	-	-	1,00	
		max	-	-	1	1	-	-	1	-	-	-	-	-	1,00	0%
	MUH	min	-	-	1	1	-	-	1	-	-	1	-	-	1,00	0%
		average	-	-	1	1	-	-	1	-	-	1	-	-	1,00	0%
		max	-	-	1	1	-	-	1	-	-	1	-	-	1,00	0%
	deviation from "common"				0%	0%			0%							
HP	SUH	min	-	0,37	-	-	-	-	0,4	-	-	-	-	-	0,38	-1%
		average	-	0,37	-	-	-	-	0,4	-	-	-	-	-	0,39	
		max	-	0,37	-	-	-	-	0,4	-	-	-	-	-	0,39	+1%
	MUH	min	-	0,37	-	-	-	-	0,4	-	-	-	-	-	0,38	-1%
		average	-	0,37	-	-	-	-	0,4	-	-	-	-	-	0,39	0%
		max	-	0,37	-	-	-	-	0,4	-	-	-	-	-	0,39	+1%
	deviation from "common"			-4%					+4%							
HP_Air	SUH	min	-	-	0,35	0,35	-	0,86	0,33	0,36	0,4	-	0,4	0,36	0,42	-5%
		average	-	-	0,39	0,4	-	0,86	0,33	0,36	0,4	-	0,4	0,36	0,44	
		max	-	-	0,42	0,45	-	0,86	0,33	0,36	0,4	-	0,4	0,36	0,49	+13%
	MUH	min	-	-	0,35	0,35	-	0,86	0,33	-	0,4	-	0,4	0,36	0,42	-6%
		average	-	-	0,39	0,4	-	0,86	0,33	-	0,4	-	0,4	0,36	0,45	+3%
		max	-	-	0,42	0,45	-	0,86	0,33	-	0,4	-	0,4	0,36	0,51	+14%
	deviation from "common"				-12%	-10%		+94%	-26%		-10%		-10%	-19%		
HP_Ground	SUH	min	-	-	0,29	0,29	-	-	0,22	0,38	0,33	0,25	0,33	0,29	0,29	-5%
		average	-	-	0,31	0,32	-	-	0,22	0,38	0,33	0,25	0,33	0,29	0,30	
		max	-	-	0,32	0,36	-	-	0,22	0,38	0,33	0,25	0,33	0,29	0,32	+5%
	MUH	min	-	-	0,29	0,29	-	-	0,22	-	0,33	-	0,33	0,29	0,28	-6%
		average	-	-	0,31	0,32	-	-	0,22	-	0,33	-	0,33	0,29	0,30	-1%
		max	-	-	0,32	0,36	-	-	0,22	-	0,33	-	0,33	0,29	0,32	+5%
	deviation from "common"				+3%	+6%			-27%		+9%		+9%	-4%		
HP_ExhAir	SUH	min	-	-	0,3	0,3	-	-	0,29	-	-	-	0,33	-	0,30	-1%
		average	-	-	0,3	0,3	-	-	0,29	-	-	-	0,33	-	0,31	
		max	-	-	0,3	0,3	-	-	0,29	-	-	-	0,33	-	0,31	+2%
	MUH	min	-	-	0,3	0,3	-	-	0,29	-	-	-	0,33	-	0,30	-1%
		average	-	-	0,3	0,3	-	-	0,29	-	-	-	0,33	-	0,31	0%
		max	-	-	0,3	0,3	-	-	0,29	-	-	-	0,33	-	0,31	+2%
	deviation from "common"				-2%	-2%			-5%				+8%			
HP_Water	SUH	min	-	-	-	-	-	-	0,25	-	-	-	-	-	0,25	0%
		average	-	-	-	-	-	-	0,25	-	-	-	-	-	0,25	
		max	-	-	-	-	-	-	0,25	-	-	-	-	-	0,25	0%
	MUH	min	-	-	-	-	-	-	0,25	-	-	-	-	-	0,25	0%
		average	-	-	-	-	-	-	0,25	-	-	-	-	-	0,25	0%
		max	-	-	-	-	-	-	0,25	-	-	-	-	-	0,25	0%
	deviation from "common"								0%							
HP_Cellar	SUH	min	-	-	-	0,35	-	-	0,3	-	-	-	-	-	0,32	-5%
		average	-	-	-	0,37	-	-	0,3	-	-	-	-	-	0,34	
		max	-	-	-	0,39	-	-	0,3	-	-	-	-	-	0,36	+7%
	MUH	min	-	-	-	0,35	-	-	0,3	-	-	-	-	-	0,32	-5%
		average	-	-	-	0,37	-	-	0,3	-	-	-	-	-	0,34	0%
		max	-	-	-	0,39	-	-	0,3	-	-	-	-	-	0,36	+7%
	deviation from "common"					+10%			-10%							
HP_Other	SUH	min	-	-	-	-	-	-	-	-	-	-	-	-	-	
		average	-	-	-	-	-	-	-	-	-	-	-	-	-	
		max	-	-	-	-	-	-	-	-	-	-	-	-	-	
	MUH	min	-	-	-	-	-	-	-	-	-	-	-	-	-	
		average	-	-	-	-	-	-	-	-	-	-	-	-	-	
		max	-	-	-	-	-	-	-	-	-	-	-	-	-	
	deviation from "common"															
TS	SUH	min	1,02	-	1,02	1,14	1,03	-	1,05	-	-	1,15	1,02	1	1,05	-2%
		average	1,02	-	1,04	1,14	1,05	-	1,15	-	-	1,15	1,02	1	1,07	
		max	1,02	-	1,05	1,14	1,06	-	1,25	-	-	1,15	1,02	1	1,10	+3%
	MUH	min	1,02	-	1,02	1,14	1,03	2,39	1,05	-	-	1,15	1,02	1	1,18	-3%
		average	1,02	-	1,04	1,14	1,05	2,39	1,15	-	-	1,15	1,02	1	1,22	+14%
		max	1,02	-	1,05	1,14	1,06	2,39	1,25	-	-	1,15	1,02	1	1,35	+11%
	deviation from "common"		-11%		-9%	-0%	-8%		+0%			+0%	-11%	-13%		

			AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common	deviation
CHP	SUH	min	-	-	-	1,67	-	-	1,18	-	-	1,27	-	-	1,33	-5%
		average	-	-	-	1,67	-	-	1,24	-	-	1,27	-	-	1,39	
		max	-	-	-	1,67	-	-	1,3	-	-	1,27	-	-	1,48	+6%
	MUH	min	-	-	-	1,67	-	-	1,18	-	-	1,27	-	-	1,33	-5%
		average	-	-	-	1,67	-	-	1,24	-	-	1,27	-	-	1,39	0%
		max	-	-	-	1,67	-	-	1,3	-	-	1,27	-	-	1,48	+6%
	deviation from "common"					+20%			-11%			-9%				
Solar	SUH	min	0	0,15	0	0	0	0	0	0	0	0	0	0	0,01	-55%
		average	0	0,31	0	0	0	0	0	0	0	0	0	0	0,03	
		max	0	0,47	0	0	0	0	0	0	0	0	0	0	0,07	+180%
	MUH	min	0	0,15	0	0	0	0	0	0	0	0	0	0	0,01	-55%
		average	0	0,31	0	0	0	0	0	0	0	0	0	0	0,03	0%
		max	0	0,47	0	0	0	0	0	0	0	0	0	0	0,07	+180%
	deviation from "common"		-100%	+1100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%		

Table 28: Deviations from averages ("common values") per country

	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI
B	+5%						-5%					
B_NC	+4%	+1%					+13%		-1%		-9%	-0%
B_NC_CT	-4%	+10%	-2%	+0%	-14%	+53%	-16%	-4%		+0%		-22%
B_NC_LT	-10%		+8%	+1%		+38%	-11%			-11%		-14%
B_C	-12%		+7%	+4%	-11%	+44%	-8%	-6%	-5%	-5%		-8%
B_WP	-14%		-15%	-6%							-20%	+2%
G_IWH	-13%						-3%			+39%		-24%
G_IWH_NC		-2%	-1%	-1%			-7%		+32%	-11%		-12%
G_IWH_C				+6%			-8%		+2%			
G_Tank			+9%	+9%			-0%					-18%
E	-6%	-7%					-3%		+24%			-7%
E_Immersion				-10%		+37%	-4%	-10%			-8%	
E_IWH			0%	0%			0%					
HP		-4%					+4%					
HP_Air			-12%	-10%		+94%	-26%		-10%		-10%	-19%
HP_Ground			+3%	+6%			-27%		+9%		+9%	-4%
HP_ExhAir			-2%	-2%			-5%				+8%	
HP_Water							0%					
HP_Cellar				+10%			-10%					
HP_Other												
TS	-11%		-9%	-0%	-8%		+0%			+0%	-11%	-13%
CHP				+20%			-11%			-9%		
Solar	-100%	+1100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%	-100%

Table 29: Energy expenditure factors heat generation (dhw systems) / merged and condensed values

heat generator type		energy efficiency	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common
B_NC	boiler, non-condensing	poor	1,59	1,85	1,54	1,76	1,54	3,27	1,53	1,62	1,53	1,54	1,40	1,35	2,49
		medium	1,35	1,52	1,44	1,42	1,25	2,06	1,32	1,48	1,34	1,34	1,23	1,22	1,41
		high	1,14	1,28	1,33	1,20	1,07	1,57	1,09	1,25	1,17	1,11	1,11	1,10	1,14
	consideration in "common"		1	1	1	1	1	1	1	1	1	1	1	1	n=12
B_C	boiler, condensing	poor	1,06	1,17	1,32	1,31	1,05	1,89	1,15	1,11	1,12	1,15		1,18	1,56
		medium	1,04	1,17	1,26	1,23	1,05	1,70	1,09	1,11	1,12	1,12		1,08	1,19
		high	1,03	1,17	1,18	1,17	1,02	1,51	1,02	1,11	1,12	1,10		0,98	1,08
	consideration in "common"		1	1	1	1	1	1	1	1	1	1			n=10
B_WP	wood-pellets boiler	poor	1,34		1,33	1,63		3,44					1,25	2,00	1,76
		medium	1,34		1,33	1,48		3,44					1,25	1,60	1,40
		high	1,34		1,33	1,32		3,44					1,25	1,20	1,24
	consideration in "common"		1		1	1							1	1	n=5
G_IWH_NC	gas-fired instantaneous water heater, non-condensing	poor		1,31	1,35	1,35			1,25		2,47	1,19		1,18	1,96
		medium		1,31	1,33	1,33			1,25		1,77	1,19		1,18	1,34
		high		1,31	1,31	1,31			1,25		1,39	1,19		1,18	1,23
	consideration in "common"			1	1	1			1		1	1		1	n=7
G_IWH_C	gas-fired instantaneous water heater, condensing	poor				1,31			1,12		1,24				1,27
		medium				1,29			1,12		1,24				1,22
		high				1,27			1,12		1,24				1,17
	consideration in "common"					1			1		1				n=3
G_Tank	gas burner for directly heated DHW tank	poor			1,34	1,34			1,22					1,00	1,28
		medium			1,34	1,34			1,22					1,00	1,23
		high			1,34	1,34			1,22					1,00	1,11
	consideration in "common"				1	1			1					1	n=4
E_Immersion	electric immersion heater	poor				1,00		1,87	1,11	1,00		1,00	1,02		1,52
		medium				1,00		1,52	1,06	1,00		1,00	1,02		1,10
		high				1,00		1,37	1,00	1,00		1,00	1,02		1,03
	consideration in "common"					1		1	1	1		1	1		n=6
E	direct electric heat generator, not specified	poor	1,01	1,00	1,00	1,00	1,00		1,05		1,33	1,00		1,00	1,19
		medium	1,01	1,00	1,00	1,00	1,00		1,02		1,33	1,00		1,00	1,04
		high	1,01	1,00	1,00	1,00	1,00		1,00		1,33	1,00		1,00	1,02
	consideration in "common"		1	1	1	1	1		1		1	1		1	n=9
HP_Air	heat pump, heat source external air	poor			0,42	0,45		0,86	0,33	0,36	0,40		0,40	0,36	0,65
		medium			0,39	0,40		0,86	0,33	0,36	0,40		0,40	0,36	0,44
		high			0,35	0,35		0,86	0,33	0,36	0,40		0,40	0,36	0,38
	consideration in "common"				1	1		1	1	1	1		1	1	n=8
HP_Ground	heat pump, heat source ground	poor			0,32	0,36			0,22	0,38	0,33	0,25	0,33	0,29	0,35
		medium			0,31	0,32			0,22	0,38	0,33	0,25	0,33	0,29	0,30
		high			0,29	0,29			0,22	0,38	0,33	0,25	0,33	0,29	0,26
	consideration in "common"				1	1			1	1	1	1	1	1	n=8
HP_ExhAir	heat pump, heat source exhaust air	poor			0,30	0,30			0,29				0,33		0,32
		medium			0,30	0,30			0,29				0,33		0,31
		high			0,30	0,30			0,29				0,33		0,30
	consideration in "common"				1	1			1				1		n=4
HP_Cellar	heat pump, heat source: cellar air	poor				0,39			0,30						0,37
		medium				0,37			0,30						0,34
		high				0,35			0,30						0,31
	consideration in "common"					1			1						n=2
TS	district heating transfer station	poor	1,02		1,05	1,14	1,06	2,39	1,25			1,15	1,02	1,00	1,81
		medium	1,02		1,04	1,14	1,05	2,39	1,15			1,15	1,02	1,00	1,22
		high	1,02		1,02	1,14	1,03	2,39	1,05			1,15	1,02	1,00	1,10
	consideration in "common"		1		1	1	1	1	1			1	1	1	n=9
CHP	combined heat and power generation	poor				1,67			1,30			1,27			1,54
		medium				1,67			1,24			1,27			1,39
		high				1,67			1,18			1,27			1,28
	consideration in "common"					1			1			1			n=3
Solar	thermal solar plant	poor	0,00	0,47	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
		medium	0,00	0,31	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
		high	0,00	0,15	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
	consideration in "common"		1		1	1	1	1	1	1	1	1	1	1	n=11

Electricity generation expenditure factor

CHP	combined heat and power generation	poor	-	-	3,33	-	-	-	-	-	-	-	-	-	3,33
		medium	-	-	3,33	-	-	-	-	-	-	-	-	-	3,33
		high	-	-	3,33	-	-	-	-	-	-	-	-	-	3,33
	consideration in "common"				1										n=1

Remarks

Merging of subdivisions of heat generators

B_NC: includes values of: B_NC, B_NC_CT, B_NC_LT

E: includes values of: E, E_IWH

Determination of common values

B_C: SI: not considered / values are unrealistic low (referring to Hi instead of HS?)

B_WP FR: not considered / values are unrealistic high

Solar: BE: not considered (indicated as solar system combined with boiler, this is not the idea of the heat generator "thermal solar plant")

Figure 17: **Heat generation expenditure factors of DHW systems /**
boilers: <B_NC> non-condensing, <B_C> condensing, <B_WP> wood-pellets

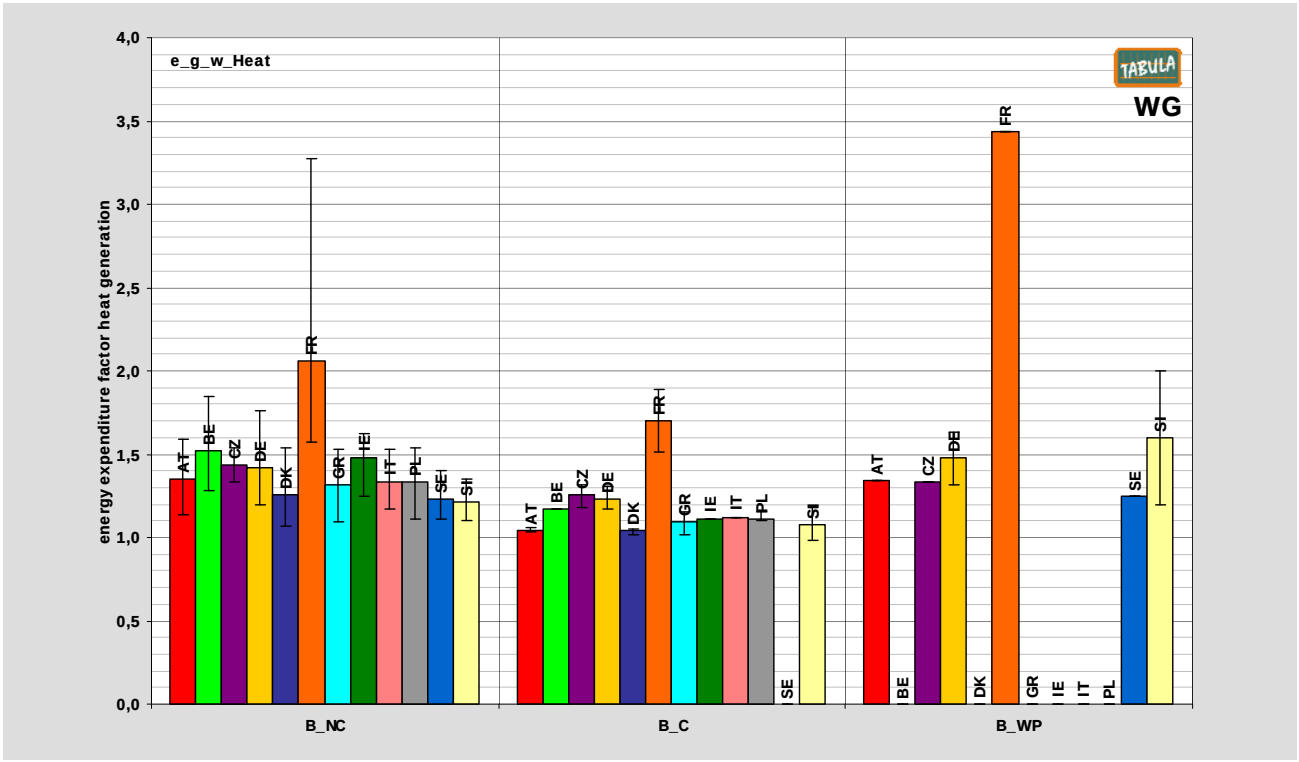


Figure 18: **Heat generation expenditure factors of DHW systems /**
<E_Immersion> electric immersion heaters, <E> or <E_IWH> electric instantaneous water heaters, electrical heat pumps, heat sources: <HP_Air> external air, <HP_Ground> ground, <HP_ExhAir> exhaust air, <HP_Cellar> cellar air

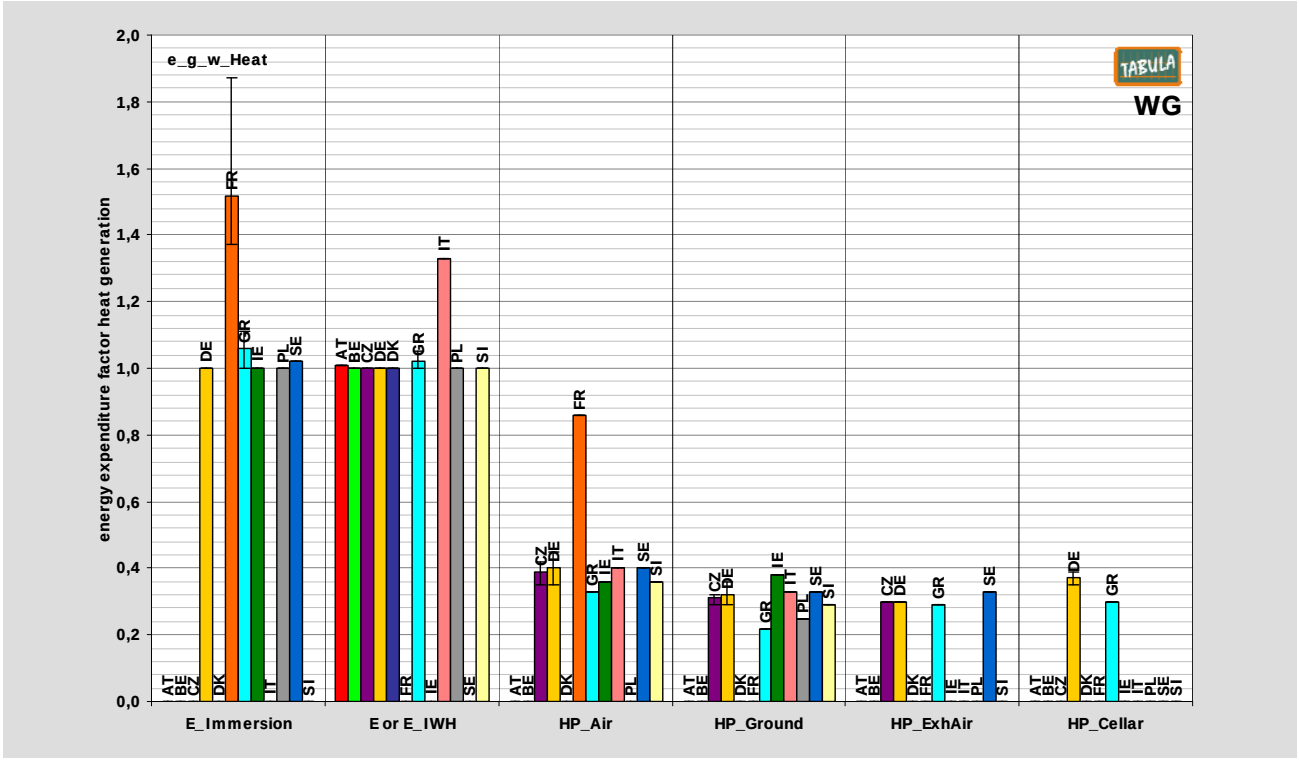


Figure 19: **Heat generation expenditure factors of DHW systems /**
gas-fired instantaneous water heaters: <G_IWH_NC> non-condensing, <G_IWH_C> condensing; <G_Tank> gas burner for directly heated DHW tank (not including storage losses), <TS> district heating transfer station

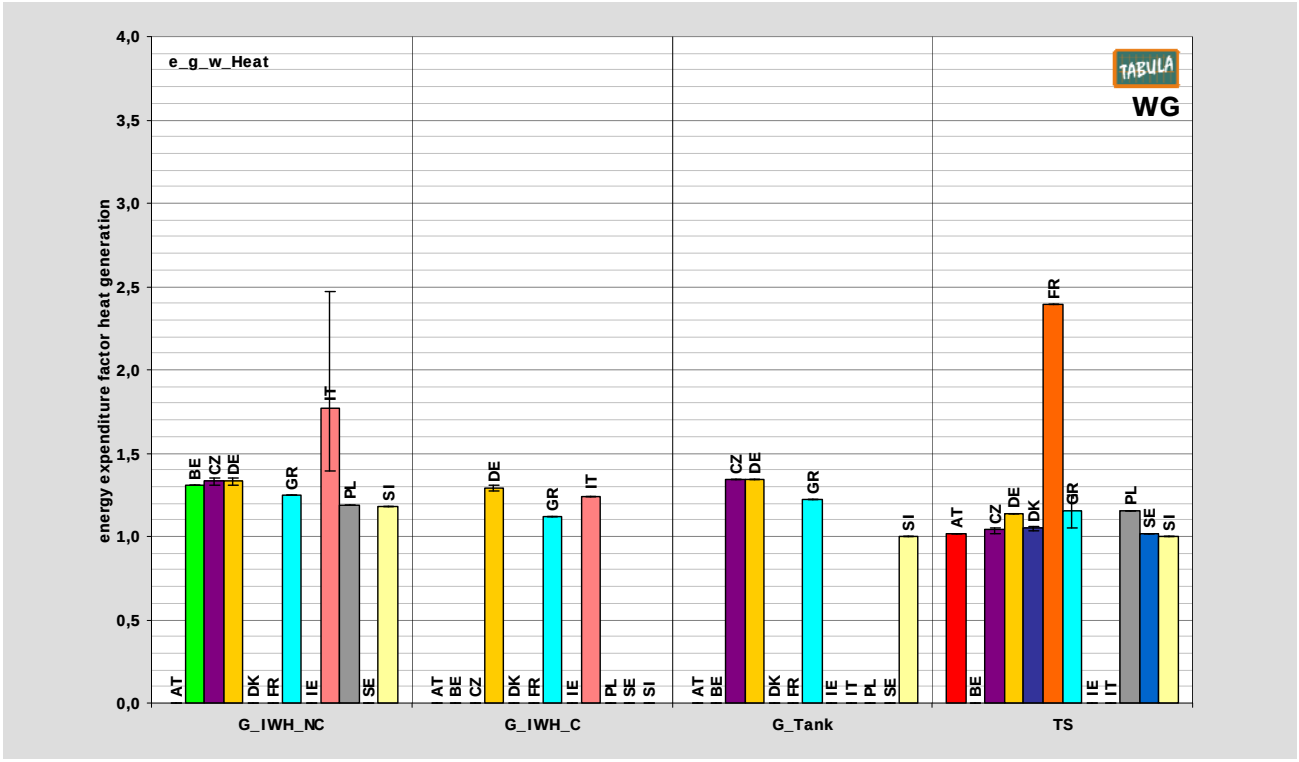


Table 30: Heat generation of dhw systems / derived default values (simplified common values)

TABULA Code	Description	heat generation expenditure factor (dhw systems)			electricity generation expenditure factor (dhw systems)		
		delivered energy demand (H_S) devided by produced heat			electricity demand devided by produced heat		
		$e_{g,w}$			$e_{g,el,w}$		
		[-]			[-]		
	energy efficiency	**poor**	**medium**	**high**	**poor**	**medium**	**high**
B_NC	boiler, non-condensing	2,49	1,41	1,14	-	-	-
B_C	boiler, condensing	1,56	1,19	1,08	-	-	-
B_WP	wood-pellets boiler	1,76	1,40	1,24	-	-	-
G_IWH_NC	gas-fired instantaneous water heater, non-condensing	1,96	1,34	1,23	-	-	-
G_IWH_C	gas-fired instantaneous water heater, condensing	1,27	1,22	1,17	-	-	-
G_Tank	gas burner for directly heated DHW tank	1,28	1,23	1,11	-	-	-
E_Immersion	electric immersion heater	1,52	1,10	1,03	-	-	-
E	direct electric heat generator, not specified	1,19	1,04	1,02	-	-	-
HP_Air	heat pump, heat source external air	0,65	0,44	0,38	-	-	-
HP_Ground	heat pump, heat source ground	0,35	0,30	0,26	-	-	-
HP_ExhAir	heat pump, heat source exhaust air	0,32	0,31	0,30	-	-	-
HP_Cellar	heat pump, heat source: cellar air	0,37	0,34	0,31	-	-	-
TS	district heating transfer station	1,81	1,22	1,10	-	-	-
CHP	combined heat and power generation	1,54	1,39	1,28	3,33	3,33	3,33
Solar	thermal solar plant	0,00	0,00	0,00	-	-	-

4.7 WS – DHW Systems / Heat Storage

Table 31: Annual heat loss of the dhw heat storage differentiated by country and by building size class

			AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common	deviation
S_D	SUH	min	4,3	-	3,9	2,9	-	0,0	2,4	-	-	1,2	-	0,2	1,9	-30%
		average	5,7	-	5,0	3,3	-	0,0	2,6	-	-	2,0	-	0,2	2,7	
		max	9,2	-	6,0	3,6	-	0,0	2,8	-	-	3,3	-	0,2	4,3	+61%
	MUH	min	4,3	-	3,9	2,9	-	0,0	2,4	-	-	1,2	-	0,2	1,9	-30%
		average	5,7	-	5,0	3,3	-	0,0	2,6	-	-	2,0	-	0,2	2,7	0%
		max	9,2	-	6,0	3,6	-	0,0	2,8	-	-	3,3	-	0,2	4,3	+61%
	deviation from "common"		+114%		+85%	+22%		-100%	-3%			-27%		-93%		
S_A	SUH	min	-	-	-	-	-	-	-	-	-	-	-	-	-	
		average	-	-	-	-	-	-	-	-	-	-	-	-	-	
		max	-	-	-	-	-	-	-	-	-	-	-	-	-	
	MUH	min	-	-	-	-	-	-	2,4	-	2,5	-	-	-	2,43	-30%
		average	-	-	-	-	-	-	2,4	-	4,5	-	-	-	3,47	
		max	-	-	-	-	-	-	2,4	-	7,4	-	-	-	5,73	+65%
	deviation from "common"															
S_C_Int	SUH	min	3,4	1,6	6,5	5,6	2,9	0,0	2,0	3,3	2,8	6,3	2,5	0,5	2,88	-60%
		average	18,7	2,4	9,3	8,1	4,0	0,0	2,0	13,3	5,1	8,5	13,7	0,5	7,13	
		max	46,7	3,5	12,0	10,5	4,7	0,0	2,0	45,1	8,4	10,6	28,8	0,5	16,88	+137%
	MUH	min	3,4	1,6	1,1	1,0	2,6	0,0	2,0	3,3	1,6	1,3	0,1	0,5	1,42	-60%
		average	18,7	2,4	1,7	1,4	2,6	0,0	2,0	7,5	3,0	1,9	1,1	0,5	3,55	-50%
		max	46,7	3,5	2,2	1,8	2,6	0,0	2,0	14,6	4,9	2,4	2,0	0,5	9,99	+181%
	deviation from "common"		+250%	-56%	+2%	-11%	-38%	-100%	-63%	+95%	-24%	-4%	+38%	-91%		
S_C_Ext	SUH	min	-	1,9	6,5	5,6	-	0,0	-	-	3,6	12,0	-	0,5	3,77	-33%
		average	-	2,8	9,3	8,1	-	0,0	-	-	6,6	12,0	-	0,5	5,60	
		max	-	4,2	12,0	10,5	-	0,0	-	-	10,7	12,0	-	0,5	7,73	+38%
	MUH	min	-	1,9	1,1	1,0	-	0,0	-	-	2,1	1,3	-	0,5	0,99	-42%
		average	-	2,8	1,7	1,4	-	0,0	-	-	3,8	1,9	-	0,5	1,72	-69%
		max	-	4,2	2,2	1,8	-	0,0	-	-	6,2	2,4	-	0,5	2,93	+71%
	deviation from "common"			-23%	+49%	+29%		-100%			+42%	+89%		-86%		
S_Gas	SUH	min	-	-	18,0	22,5	-	-	2,2	-	-	-	-	0,0	8,54	-20%
		average	-	-	18,0	22,5	-	-	2,2	-	-	-	-	0,0	10,68	
		max	-	-	18,0	22,5	-	-	2,2	-	-	-	-	0,0	13,04	+22%
	MUH	min	-	-	18,0	22,5	-	-	2,2	-	-	-	-	0,0	8,54	-20%
		average	-	-	18,0	22,5	-	-	2,2	-	-	-	-	0,0	10,68	0%
		max	-	-	18,0	22,5	-	-	2,2	-	-	-	-	0,0	13,04	+22%
	deviation from "common"				+69%	+111%			-79%					-100%		
Other	SUH	min	-	-	-	-	-	-	3,1	-	-	-	-	-	3,10	0%
		average	-	-	-	-	-	-	3,1	-	-	-	-	-	3,10	
		max	-	-	-	-	-	-	3,1	-	-	-	-	-	3,10	0%
	MUH	min	-	-	-	-	-	-	3,1	-	-	-	-	-	3,10	0%
		average	-	-	-	-	-	-	3,1	-	-	-	-	-	3,10	0%
		max	-	-	-	-	-	-	3,1	-	-	-	-	-	3,10	0%
	deviation from "common"								0%							

Table 32: Portion of the dhw storage heat losses which is recoverable during the heating season differentiated by country and by building size class

			AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common	deviation
S_D	SUH	min	-	-	2,3	1,9	-	0,0	0,0	-	-	1,2	-	0,2	0,8	-41%
		average	-	-	2,6	2,2	-	0,0	1,2	-	-	2,0	-	0,2	1,3	
		max	-	-	2,8	2,4	-	0,0	2,4	-	-	3,3	-	0,2	2,1	+54%
	MUH	min	-	-	2,3	1,9	-	0,0	0,0	-	-	1,2	-	0,2	0,8	-41%
		average	-	-	2,6	2,2	-	0,0	1,2	-	-	2,0	-	0,2	1,3	0%
		max	-	-	2,8	2,4	-	0,0	2,4	-	-	3,3	-	0,2	2,1	+54%
	deviation from "common"				+90%	+60%		-100%	-11%			+46%		-85%		
S_A	SUH	min	-	-	-	-	-	-	-	-	-	-	-	-	-	
		average	-	-	-	-	-	-	-	-	-	-	-	-	-	
		max	-	-	-	-	-	-	-	-	-	-	-	-	-	
	MUH	min	-	-	-	-	-	-	0,0	-	1,3	-	-	-	0,43	-64%
		average	-	-	-	-	-	-	0,0	-	2,4	-	-	-	1,22	
		max	-	-	-	-	-	-	0,0	-	4,0	-	-	-	2,67	+119%
	deviation from "common"															
S_C_Int	SUH	min	-	1,0	4,3	3,6	2,9	0,0	0,0	3,0	1,5	6,3	1,0	0,0	1,96	-48%
		average	-	1,4	6,0	5,2	4,0	0,0	0,0	12,0	2,7	8,5	1,5	0,0	3,75	
		max	-	2,1	7,6	6,7	4,7	0,0	0,0	40,6	4,5	10,6	7,5	0,0	10,40	+177%
	MUH	min	-	1,0	0,8	0,6	0,6	0,0	0,0	3,0	0,9	1,3	1,0	0,0	0,77	-45%
		average	-	1,4	1,1	0,9	0,6	0,0	0,0	6,8	1,6	1,9	1,0	0,0	1,39	-63%
		max	-	2,1	1,4	1,2	0,6	0,0	0,0	13,1	2,6	2,4	1,0	0,0	3,13	+125%
	deviation from "common"			-45%	+37%	+18%	-9%	-100%	-100%	+265%	-16%	+100%	-51%	-100%		
S_C_Ext	SUH	min	-	0,0	0,0	0,0	-	0,0	-	-	0,0	0,0	-	0,5	0,06	-13%
		average	-	0,0	0,0	0,0	-	0,0	-	-	0,0	0,0	-	0,5	0,07	
		max	-	0,0	0,0	0,0	-	0,0	-	-	0,0	0,0	-	0,5	0,13	+75%
	MUH	min	-	0,0	0,0	0,0	-	0,0	-	-	0,0	0,0	-	0,5	0,06	-13%
		average	-	0,0	0,0	0,0	-	0,0	-	-	0,0	0,0	-	0,5	0,07	0%
		max	-	0,0	0,0	0,0	-	0,0	-	-	0,0	0,0	-	0,5	0,13	+75%
	deviation from "common"			-100%	-100%	-100%		-100%			-100%	-100%		+600%		
S_Gas	SUH	min	-	-	0,0	0,0	-	-	0,0	-	-	-	-	0,0	0,00	
		average	-	-	0,0	0,0	-	-	0,0	-	-	-	-	0,0	0,00	
		max	-	-	0,0	0,0	-	-	0,0	-	-	-	-	0,0	0,00	
	MUH	min	-	-	0,0	0,0	-	-	0,0	-	-	-	-	0,0	0,00	
		average	-	-	0,0	0,0	-	-	0,0	-	-	-	-	0,0	0,00	
		max	-	-	0,0	0,0	-	-	0,0	-	-	-	-	0,0	0,00	
	deviation from "common"															
Other	SUH	min	-	-	-	-	-	-	0,0	-	-	-	-	-	0,00	
		average	-	-	-	-	-	-	0,0	-	-	-	-	-	0,00	
		max	-	-	-	-	-	-	0,0	-	-	-	-	-	0,00	
	MUH	min	-	-	-	-	-	-	0,0	-	-	-	-	-	0,00	
		average	-	-	-	-	-	-	0,0	-	-	-	-	-	0,00	
		max	-	-	-	-	-	-	0,0	-	-	-	-	-	0,00	
	deviation from "common"															

Table 33: Deviations of the storage heat losses from averages ("common values") per country

	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI
S_D	+114%		+85%	+22%		-100%	-3%			-27%		-93%
S_A												
S_C_Int	+250%	-56%	+2%	-11%	-38%	-100%	-63%	+95%	-24%	-4%	+38%	-91%
S_C_Ext		-23%	+49%	+29%		-100%			+42%	+89%		-86%
S_Gas			+69%	+111%			-79%					-100%
Other							0%					

Table 34: Annual heat loss of the dhw heat storage / merged and condensed values

heat storage type		energy efficiency	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	com-mon
S_D	decentral electric hot water storage	poor	9,2		6,0	3,6		0,0	2,8			3,3		0,2	6,7
		medium	5,7		5,0	3,3		0,0	2,6			2,0		0,2	3,1
		high	4,3		3,9	2,9		0,0	2,4			1,2		0,2	1,3
	consideration in "common"		1		1	1			1			1		1	n=6
S_C_Int	central hot water storage, inside of thermal envelope	poor	46,7	3,5	12,0	10,5	4,7	0,0	2,0	45,1	8,4	10,6	28,8	0,5	31,2
		medium	18,7	2,4	5,5	4,7	3,3	0,0	2,0	10,4	4,1	5,2	7,4	0,5	5,8
		high	3,4	1,6	1,1	1,0	2,6	0,0	2,0	3,3	1,6	1,3	0,1	0,5	0,9
	consideration in "common"		1	1	1	1	1		1	1	1	1	1	1	n=11
S_C_Ext	central hot water storage, outside of thermal envelope	poor		4,2	12,0	10,5		0,0			10,7	12,0		0,5	10,2
		medium		2,8	5,5	4,7		0,0			5,2	6,9		0,5	4,3
		high		1,9	1,1	1,0		0,0			2,1	1,3		0,5	0,9
	consideration in "common"			1	1	1					1	1		1	n=6
S_Gas	directly gas heated hot water storage	poor			18,0	22,5			2,2					0,0	18,4
		medium			18,0	22,5			2,2					0,0	14,2
		high			18,0	22,5			2,2					0,0	8,2
	consideration in "common"				1	1			1						n=3

Remarks
Determination of common values
all types: FR: not considered / 0 kWh/(m²a) is not plausible

Table 35: Portion of the dhw storage heat losses which is recoverable during the heating season / merged and condensed values

heat storage type		energy efficiency	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	com-mon
S_D	decentral electric hot water storage	poor			2,8	2,4		0,0	2,4			3,3		0,2	2,8
		medium			2,6	2,2		0,0	1,2			2,0		0,2	1,6
		high			2,3	1,9		0,0	0,0			1,2		0,2	0,6
	consideration in "common"				1	1			1			1		1	n=5
S_C_Int	central hot water storage, inside of thermal envelope	poor		2,1	7,6	6,7	4,7	0,0	0,0	40,6	4,5	10,6	7,5	0,0	24,5
		medium		1,4	3,5	3,0	2,3	0,0	0,0	9,4	2,2	5,2	1,3	0,0	2,8
		high		1,0	0,8	0,6	0,6	0,0	0,0	3,0	0,9	1,3	1,0	0,0	0,5
	consideration in "common"			1	1	1	1		1	1	1	1	1	1	n=10
S_C_Ext	central hot water storage, outside of thermal envelope	poor		0,0	0,0	0,0		0,0			0,0	0,0		0,5	0,0
		medium		0,0	0,0	0,0		0,0			0,0	0,0		0,5	0,0
		high		0,0	0,0	0,0		0,0			0,0	0,0		0,5	0,0
	consideration in "common"			1	1	1					1	1			n=5
S_Gas	directly gas heated hot water storage	poor			0,0	0,0			0,0					0,0	0,0
		medium			0,0	0,0			0,0					0,0	0,0
		high			0,0	0,0			0,0					0,0	0,0
	consideration in "common"				1	1			1						n=3

Figure 20: Annual storage heat losses of DHW systems + recoverable fraction

<S_D> decentral electric hot water storage; <S_C_Ent> central hot water storage, inside of thermal envelope; <S_C_Ext> central hot water storage, outside of thermal envelope; <S_Gas> directly gas heated hot water storage

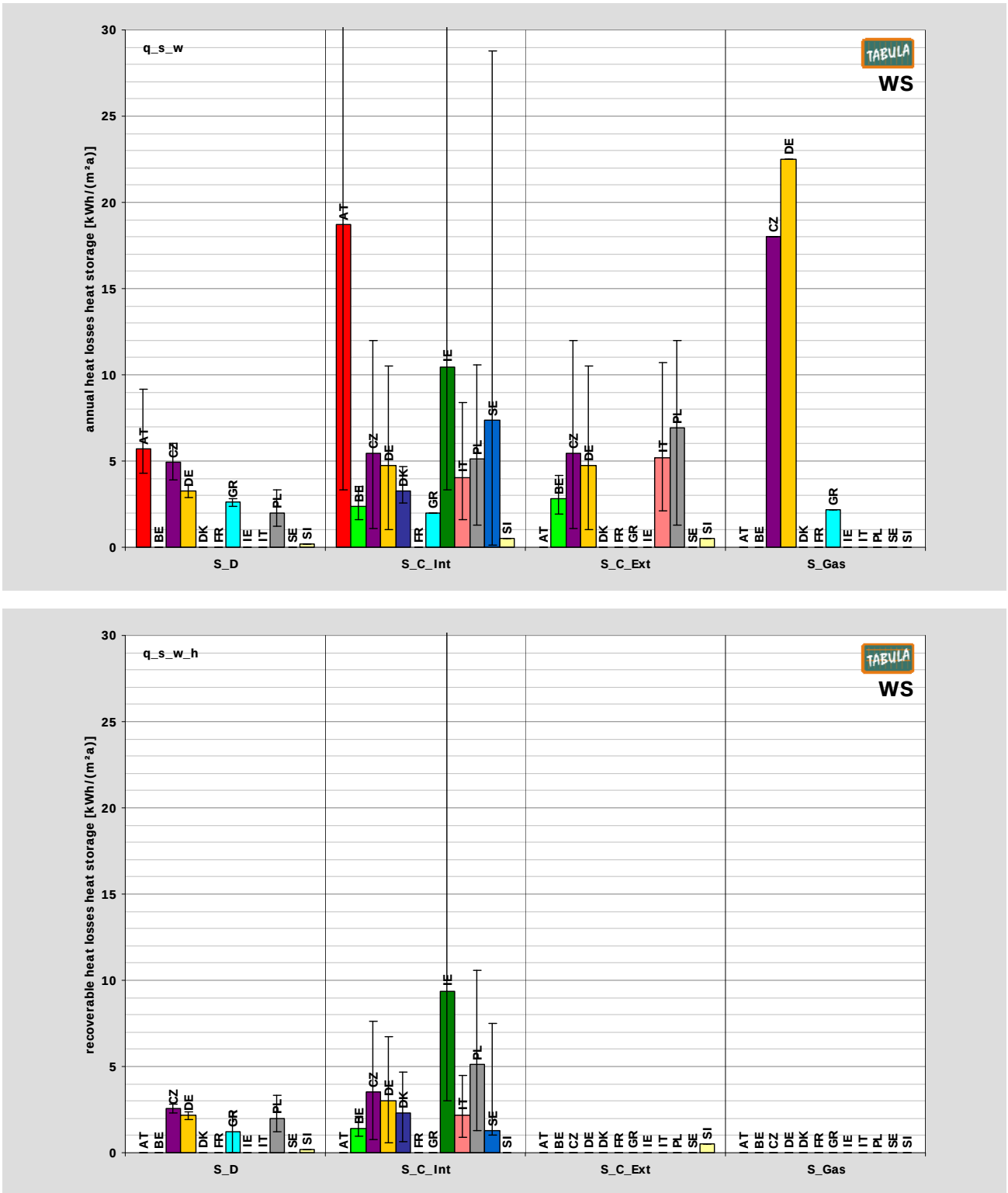


Table 36: Annual heat loss of the dhw heat storage / derived default values (simplified common values)

TABULA code	description	heat loss of the dhw distribution			thereof recoverable portion		
		annual heat losses per m² reference area			contribution to space heating per m² reference area		
		$q_{d,w}$			$q_{d,w,h}$		
		[kWh/(m²a)]			[kWh/(m²a)]		
	energy efficiency	**poor**	**medium**	**high**	**poor**	**medium**	**high**
S_D	decentral electric hot water storage	6,7	3,1	1,3	2,8	1,6	1,6
S_C_Int	central hot water storage, inside of thermal envelope	31,2	5,8	0,9	24,5	2,8	2,8
S_C_Ext	central hot water storage, outside of thermal envelope	10,2	4,3	0,9	0,0	0,0	0,0
S_Gas	directly gas heated hot water storage	18,4	14,2	8,2	0,0	0,0	0,0

4.8 WD – Domestic Hot Water Systems / Heat Distribution

Table 37: Annual heat losses of the dhw distribution / differentiated by country and by building size class

			AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common	deviation
D	SUH	min	5,0	-	1,5	1,4	-	0,0	0,9	-	-	-	-	-	1,5	-40%
		average	5,0	-	3,3	3,0	-	0,0	0,9	-	-	-	-	-	2,4	
		max	5,0	-	5,1	4,6	-	0,0	0,9	-	-	-	-	-	3,5	+41%
	MUH	min	5,0	-	1,5	1,4	-	0,0	0,9	-	-	-	-	-	1,5	-40%
		average	5,0	-	3,3	3,0	-	0,0	0,9	-	-	-	-	-	2,4	0%
		max	5,0	-	5,1	4,6	-	0,0	0,9	-	-	-	-	-	3,5	+41%
	deviation from "common"		+105%		+35%	+23%		-100%	-63%							
C	SUH	min	-	-	-	-	-	-	2,8	-	-	-	-	-	2,80	-27%
		average	-	-	-	-	-	-	3,9	-	-	-	-	-	3,85	
		max	-	-	-	-	-	-	4,9	-	-	-	-	-	4,90	+27%
	MUH	min	-	-	-	-	-	-	2,8	-	-	-	-	-	2,80	-27%
		average	-	-	-	-	-	-	3,9	-	-	-	-	-	3,85	0%
		max	-	-	-	-	-	-	4,9	-	-	-	-	-	4,90	+27%
	deviation from "common"								0%							
C_NoCirc_Int	SUH	min	14,0	0,5	4,4	-	4,5	0,0	1,5	2,9	0,8	-	-	0,6	2,92	-26%
		average	14,0	0,9	4,4	-	4,5	0,0	2,8	7,1	1,1	-	-	0,6	3,92	
		max	14,0	1,3	4,4	-	4,5	0,0	4,1	12,2	1,3	-	-	0,6	5,64	+44%
	MUH	min	14,0	0,8	4,4	-	-	0,0	1,5	2,9	-	-	-	0,6	3,03	-30%
		average	14,0	1,5	4,4	-	-	0,0	2,8	6,9	-	-	-	0,6	4,31	+10%
		max	14,0	2,1	4,4	-	-	0,0	4,1	12,2	-	-	-	0,6	6,43	+49%
	deviation from "common"		+240%	-71%	+7%			-100%	-32%	+70%				-85%		
C_NoCirc_Ext	SUH	min	-	-	-	4,4	-	0,0	1,8	-	-	13,2	-	-	3,88	-38%
		average	-	-	-	8,3	-	0,0	3,7	-	-	13,2	-	-	6,30	
		max	-	-	-	12,7	-	0,0	6,2	-	-	13,2	-	-	9,06	+44%
	MUH	min	-	-	-	4,4	-	-	1,8	-	-	8,0	-	-	4,00	-44%
		average	-	-	-	8,3	-	-	5,3	-	-	8,0	-	-	7,20	+14%
		max	-	-	-	12,7	-	-	10,4	-	-	8,0	-	-	10,95	+52%
	deviation from "common"					+23%			-33%			+57%				
NoCirc_A	SUH	min	-	-	-	-	-	-	-	-	-	-	-	-	-	
		average	-	-	-	-	-	-	-	-	-	-	-	-	-	
		max	-	-	-	-	-	-	-	-	-	-	-	-	-	
	MUH	min	-	-	-	-	-	-	-	-	1,3	-	-	-	1,30	-19%
		average	-	-	-	-	-	-	-	-	1,6	-	-	-	1,60	
		max	-	-	-	-	-	-	-	-	1,9	-	-	-	1,90	+19%
	deviation from "common"															
C_Circ_Int	SUH	min	7,1	13,4	-	-	-	-	2,4	-	2,2	4,7	0,0	1,0	3,85	-40%
		average	15,8	13,4	-	-	-	-	4,4	-	5,5	4,7	0,0	1,0	6,40	
		max	29,6	13,4	-	-	-	-	6,6	-	10,2	4,7	0,0	1,0	11,89	+86%
	MUH	min	7,1	9,5	-	-	7,7	0,0	1,5	-	2,0	4,7	15,0	1,0	4,85	-31%
		average	15,8	10,7	-	-	7,7	0,0	3,7	-	5,1	4,7	15,0	1,0	7,08	+11%
		max	29,6	11,9	-	-	7,7	0,0	6,6	-	9,1	4,7	15,0	1,0	11,52	+63%
	deviation from "common"		+135%	+79%					-40%		-21%	-30%	+11%	-85%		
C_Circ_Ext	SUH	min	-	45,1	7,1	6,5	-	-	1,8	-	3,0	-	-	-	10,88	-38%
		average	-	45,1	15,8	14,4	-	-	5,0	-	7,5	-	-	-	17,56	
		max	-	45,1	29,6	26,9	-	-	9,5	-	13,9	-	-	-	28,35	+61%
	MUH	min	-	30,2	7,0	6,4	-	0,0	1,8	-	2,8	9,8	-	-	7,25	-44%
		average	-	34,3	17,2	15,6	-	0,0	6,6	-	7,0	9,8	-	-	12,93	-26%
		max	-	38,4	34,0	30,9	-	0,0	16,0	-	12,4	9,8	-	-	22,49	+74%
	deviation from "common"			+160%	+8%	-2%			-62%		-53%					
Circ_A	SUH	min	-	-	-	-	-	-	-	-	-	-	-	-	-	
		average	-	-	-	-	-	-	-	-	-	-	-	-	-	
		max	-	-	-	-	-	-	-	-	-	-	-	-	-	
	MUH	min	-	-	-	-	-	-	0,8	-	-	-	-	-	0,80	-30%
		average	-	-	-	-	-	-	1,2	-	-	-	-	-	1,15	
		max	-	-	-	-	-	-	1,5	-	-	-	-	-	1,50	+30%
	deviation from "common"															

Table 38: Portion of the dhw distribution heat losses which is recoverable during the heating season / differentiated by country and by building size class

			AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common	deviation
D	SUH	min	3,0	-	0,9	0,8	-	0,0	0,9	-	-	-	-	-	0,9	-41%
		average	3,0	-	2,1	1,9	-	0,0	0,9	-	-	-	-	-	1,6	
		max	3,0	-	3,3	3,0	-	0,0	0,9	-	-	-	-	-	2,3	+42%
	MUH	min	3,0	-	0,9	0,8	-	0,0	0,9	-	-	-	-	-	0,9	-41%
		average	3,0	-	2,1	1,9	-	0,0	0,9	-	-	-	-	-	1,6	0%
		max	3,0	-	3,3	3,0	-	0,0	0,9	-	-	-	-	-	2,3	+42%
	deviation from "common"		+90%		+33%	+20%		-100%	-43%							
C	SUH	min	-	-	-	-	-	-	0,3	-	-	-	-	-	0,30	-54%
		average	-	-	-	-	-	-	0,7	-	-	-	-	-	0,65	
		max	-	-	-	-	-	-	1,0	-	-	-	-	-	1,00	+54%
	MUH	min	-	-	-	-	-	-	0,3	-	-	-	-	-	0,30	-54%
		average	-	-	-	-	-	-	0,7	-	-	-	-	-	0,65	0%
		max	-	-	-	-	-	-	1,0	-	-	-	-	-	1,00	+54%
	deviation from "common"								0%							
C_NoCirc_Int	SUH	min	6,6	0,3	2,0	-	1,1	0,0	1,2	2,3	0,4	-	-	0,5	1,44	-32%
		average	6,6	0,6	2,0	-	1,1	0,0	2,3	5,7	0,5	-	-	0,5	2,13	
		max	6,6	0,8	2,0	-	1,1	0,0	3,3	9,8	0,6	-	-	0,5	3,45	+62%
	MUH	min	6,6	0,5	2,0	-	-	0,0	1,2	2,3	-	-	-	0,5	1,64	-36%
		average	6,6	0,9	2,0	-	-	0,0	2,3	5,5	-	-	-	0,5	2,54	+19%
		max	6,6	1,3	2,0	-	-	0,0	3,3	9,8	-	-	-	0,5	4,16	+64%
	deviation from "common"		+183%	-69%	-14%			-100%	-4%	+140%				-79%		
C_NoCirc_Ext	SUH	min	-	-	-	1,7	-	0,0	1,0	-	-	6,8	-	-	1,90	-37%
		average	-	-	-	3,8	-	0,0	1,5	-	-	6,8	-	-	3,03	
		max	-	-	-	6,0	-	0,0	2,9	-	-	6,8	-	-	4,50	+48%
	MUH	min	-	-	-	1,7	-	-	1,1	-	-	4,2	-	-	2,03	-37%
		average	-	-	-	3,8	-	-	1,6	-	-	4,2	-	-	3,21	+6%
		max	-	-	-	6,0	-	-	2,9	-	-	4,2	-	-	4,78	+49%
	deviation from "common"					+23%			-50%			+76%				
NoCirc_A	SUH	min	-	-	-	-	-	-	-	-	-	-	-	-	-	
		average	-	-	-	-	-	-	-	-	-	-	-	-	-	
		max	-	-	-	-	-	-	-	-	-	-	-	-	-	
	MUH	min	-	-	-	-	-	-	-	-	0,6	-	-	-	0,60	-25%
		average	-	-	-	-	-	-	-	-	0,8	-	-	-	0,80	
		max	-	-	-	-	-	-	-	-	1,0	-	-	-	1,00	+25%
	deviation from "common"															
C_Circ_Int	SUH	min	2,7	8,1	-	-	-	-	1,9	-	0,4	1,8	6,0	0,8	2,76	-33%
		average	7,7	8,1	-	-	-	-	3,5	-	1,1	1,8	6,0	0,8	4,14	
		max	15,3	8,1	-	-	-	-	5,3	-	2,0	1,8	6,0	0,8	6,83	+65%
	MUH	min	2,7	3,8	-	-	1,9	0,0	1,2	-	0,4	1,8	6,0	0,8	1,86	-37%
		average	7,7	4,3	-	-	1,9	0,0	2,9	-	1,0	1,8	6,0	0,8	2,93	-29%
		max	15,3	4,7	-	-	1,9	0,0	5,3	-	1,8	1,8	6,0	0,8	5,29	+81%
	deviation from "common"		+118%	+75%					-9%		-71%	-49%	+70%	-77%		
C_Circ_Ext	SUH	min	-	27,1	2,7	2,5	-	-	1,0	-	0,6	-	-	-	5,75	-37%
		average	-	27,1	7,7	7,0	-	-	2,1	-	1,5	-	-	-	9,07	
		max	-	27,1	15,3	13,9	-	-	4,7	-	2,8	-	-	-	15,15	+67%
	MUH	min	-	12,1	3,2	2,9	-	0,0	1,1	-	0,6	7,1	-	-	3,38	-44%
		average	-	13,8	9,4	8,5	-	0,0	2,1	-	1,4	7,1	-	-	6,05	-33%
		max	-	15,4	19,4	17,6	-	0,0	4,7	-	2,5	7,1	-	-	10,76	+78%
	deviation from "common"			+170%	+13%	+3%			-72%		-81%					
Circ_A	SUH	min	-	-	-	-	-	-	-	-	-	-	-	-	-	
		average	-	-	-	-	-	-	-	-	-	-	-	-	-	
		max	-	-	-	-	-	-	-	-	-	-	-	-	-	
	MUH	min	-	-	-	-	-	-	0,8	-	-	-	-	-	0,80	-20%
		average	-	-	-	-	-	-	1,0	-	-	-	-	-	1,00	
		max	-	-	-	-	-	-	1,2	-	-	-	-	-	1,20	+20%
	deviation from "common"															

Table 39: Deviations of the distribution heat losses from averages ("common values") per country

	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI
D	+105%		+35%	+23%		-100%	-63%					
C							0%					
C_NoCirc_Int	+240%	-71%	+7%			-100%	-32%	+70%				-85%
C_NoCirc_Ext				+23%			-33%			+57%		
NoCirc_A												
C_Circ_Int	+135%	+79%					-40%		-21%	-30%	+11%	-85%
C_Circ_Ext		+160%	+8%	-2%			-62%		-53%			
Circ_A												

Table 40: Annual heat losses of the dhw distribution / merged and condensed values

heat distribution type		energy efficiency	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common
D	decentral DHW system	poor	5,0		5,1	4,6		0,0	0,9						4,5
		medium	5,0		3,3	3,0		0,0	0,9						3,1
		high	5,0		1,5	1,4		0,0	0,9						1,6
	consideration in "common"		1		1	1			1						n=4
C_NoCirc_Int	central DHW distribution, all pipes inside of thermal envelope, no circulation	poor	14,0	2,1	4,4		4,5	0,0	4,1	12,2	1,3			0,6	9,7
		medium	14,0	1,2	4,4		4,5	0,0	2,8	7,0	1,1			0,6	4,4
		high	14,0	0,5	4,4		4,5	0,0	1,5	2,9	0,8			0,6	2,1
	consideration in "common"		1	1	1		1		1	1	1			1	n=8
C_NoCirc_Ext	central DHW distribution, fraction of pipeline outside of thermal envelope, no circulation	poor				12,7		0,0	10,4			13,2			12,7
		medium				8,3		0,0	4,5			10,6			7,8
		high				4,4		0,0	1,8			8,0			3,3
	consideration in "common"					1			1			1			n=3
C_Circ_Int	central DHW distribution with circulation, all pipes inside of thermal envelope	poor	29,6	13,4			7,7	0,0	6,6		10,2	4,7	15,0	1,0	20,3
		medium	15,8	12,1			7,7	0,0	4,0		5,3	4,7	7,5	1,0	7,3
		high	7,1	9,5			7,7	0,0	1,5		2,0	4,7	0,0	1,0	2,1
	consideration in "common"		1	1			1		1		1	1	1	1	n=8
C_Circ_Ext	central DHW distribution with circulation, fraction of pipeline outside of thermal envelope	poor		45,1	34,0	30,9		0,0	16,0		13,9	9,8			35,0
		medium		39,7	16,5	15,0		0,0	5,8		7,2	9,8			15,7
		high		30,2	7,0	6,4		0,0	1,8		2,8	9,8			5,7
	consideration in "common"			1	1	1			1		1	1			n=6

Remarks

Determination of common values

all systems FR: not considered / 0 kWh/(m²a) is not plausible

Table 41: Portion of the dhw distribution heat losses which is recoverable during the heating season / merged and condensed values

heat distribution type		energy efficiency	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common
D	decentral DHW system	poor	3,0		3,3	3,0		0,0	0,9						2,9
		medium	3,0		2,1	1,9		0,0	0,9						2,0
		high	3,0		0,9	0,8		0,0	0,9						1,1
	consideration in "common"		1		1	1			1						n=4
C_NoCirc_Int	central DHW distribution, all pipes inside of thermal envelope, no circulation	poor	6,6	1,3	2,0		1,1	0,0	3,3	9,8	0,6			0,5	6,5
		medium	6,6	0,7	2,0		1,1	0,0	2,3	5,6	0,5			0,5	2,4
		high	6,6	0,3	2,0		1,1	0,0	1,2	2,3	0,4			0,5	1,1
	consideration in "common"		1	1	1		1		1	1	1			1	n=8
C_NoCirc_Ext	central DHW distribution, fraction of pipeline outside of thermal envelope, no circulation	poor				6,0		0,0	2,9			6,8			6,0
		medium				3,8		0,0	1,6			5,5			3,6
		high				1,7		0,0	1,0			4,2			1,7
	consideration in "common"					1			1			1			n=3
C_Circ_Int	central DHW distribution with circulation, all pipes inside of thermal envelope	poor	15,3	8,1			1,9	0,0	5,3		2,0	1,8	6,0	0,8	10,2
		medium	7,7	6,2			1,9	0,0	3,2		1,0	1,8	6,0	0,8	3,6
		high	2,7	3,8			1,9	0,0	1,2		0,4	1,8	6,0	0,8	1,4
	consideration in "common"		1	1			1		1		1	1	1	1	n=8
C_Circ_Ext	central DHW distribution with circulation, fraction of pipeline outside of thermal envelope	poor		27,1	19,4	17,6		0,0	4,7		2,8	7,1			20,1
		medium		20,4	8,6	7,8		0,0	2,1		1,5	7,1			7,9
		high		12,1	2,7	2,5		0,0	1,0		0,6	7,1			2,5
	consideration in "common"			1	1	1			1		1	1			n=6

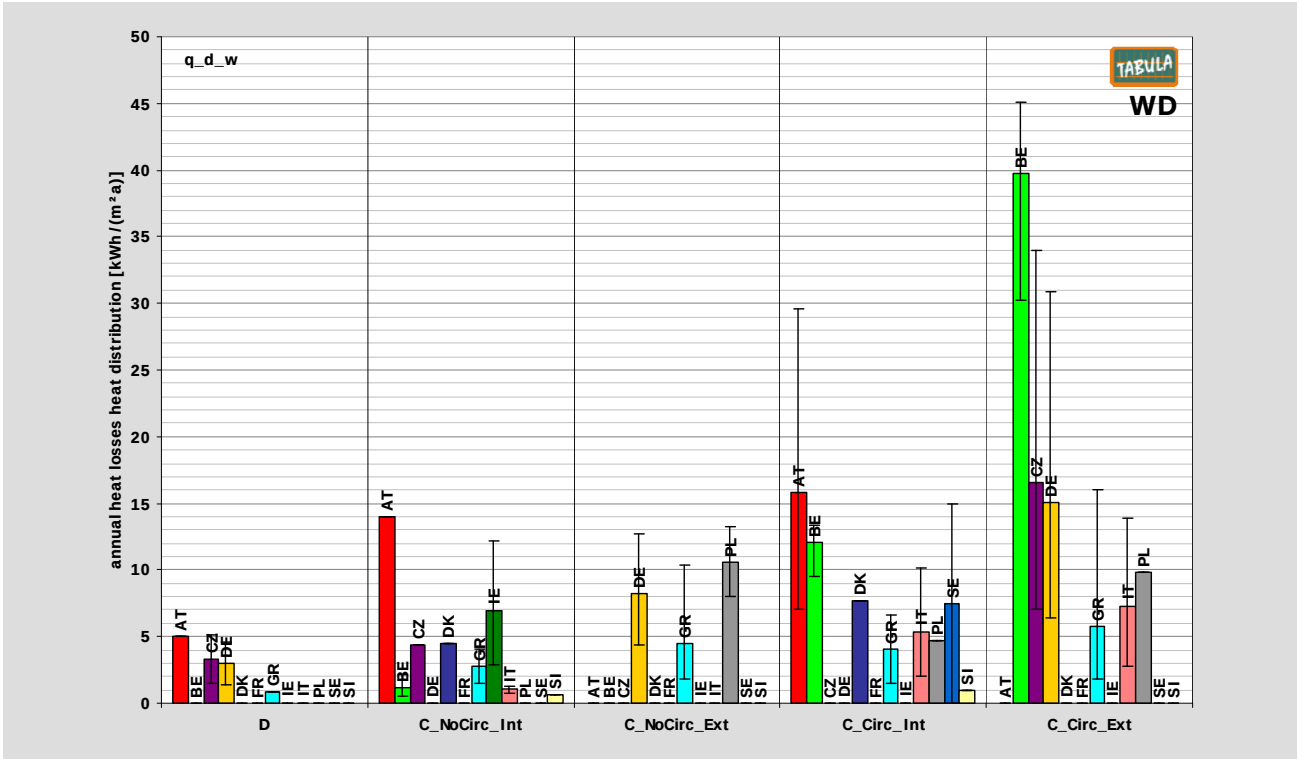
Remarks

Determination of common values

all systems FR: not considered / 0 kWh/(m²a) is not plausible

Figure 21: **Annual distribution heat losses of DHW systems + recoverable fraction**

<D> decentral DHW system; <C_NoCirc_Int> central DHW distribution, all pipes inside of thermal envelope, no circulation; <C_NoCirc_ext> central DHW distribution, fraction of pipeline outside of thermal envelope, no circulation; <C_Circ_Int> central DHW distribution with circulation, all pipes inside of thermal envelope; <C_Circ_Ext> central DHW distribution with circulation, fraction of pipeline outside of thermal envelope



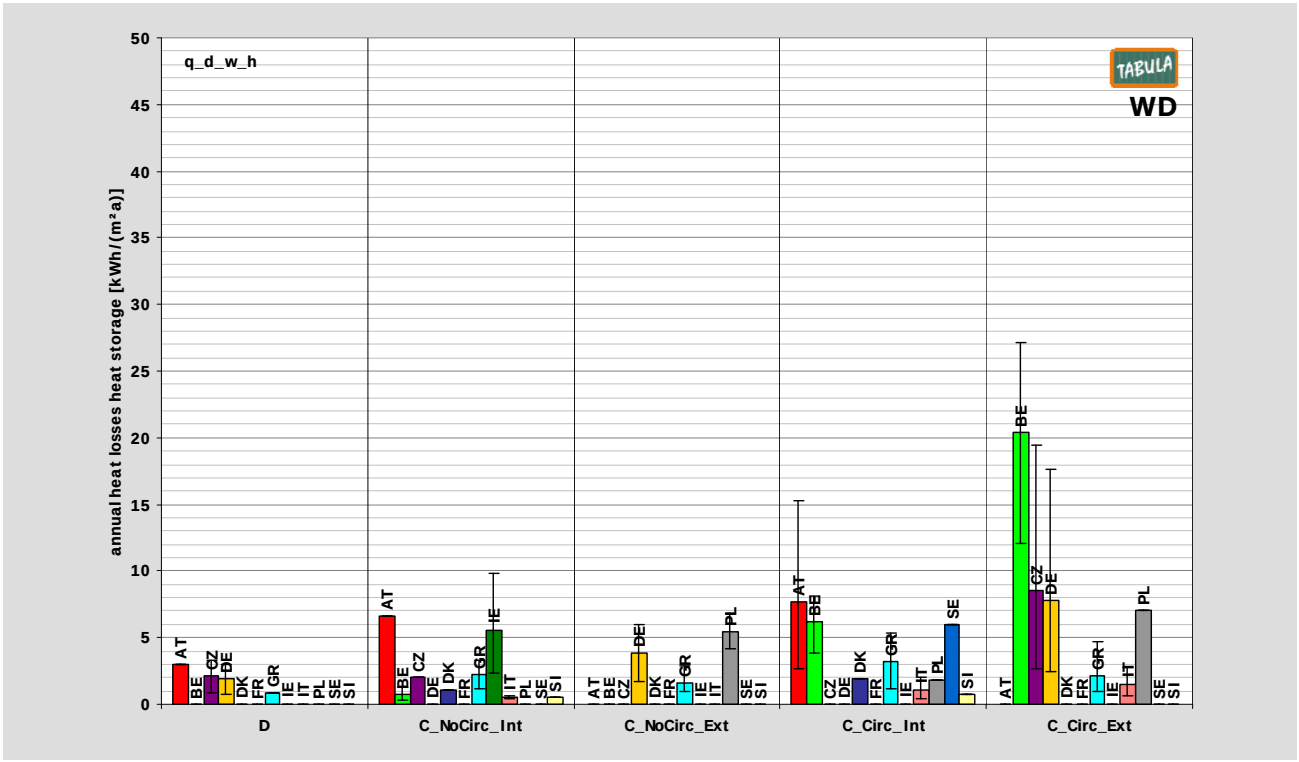


Table 42: Annual heat losses of the dhw distribution / derived default values (simplified common values)

TABULA code	description	heat loss of the dhw distribution			thereof recoverable portion		
		annual heat losses per m² reference area			contribution to space heating per m² reference area		
		$q_{d,w}$			$q_{d,w,h}$		
		[kWh/(m²a)]			[kWh/(m²a)]		
	energy efficiency	poor	medium	high	poor	medium	high
D	decentral DHW system	4,5	3,1	1,6	2,0	1,1	1,1
C_NoCirc_Int	central DHW distribution, all pipes inside of thermal envelope, no circulation	9,7	4,4	2,1	2,4	1,1	1,1
C_NoCirc_Ext	central DHW distribution, fraction of pipeline outside of thermal envelope, no circulation	12,7	7,8	3,3	3,6	1,7	1,7
C_Circ_Int	central DHW distribution with circulation, all pipes inside of thermal envelope	20,3	7,3	2,1	3,6	1,4	1,4
C_Circ_Ext	central DHW distribution with circulation, fraction of pipeline outside of thermal envelope	35,0	15,7	5,7	7,9	2,5	2,5

4.9 WA – DHW Systems / Auxiliary Energy

Table 43: Annual auxiliary electricity demand of DHW systems differentiated by country and by building size class

			AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common	deviation
D	SUH	min	0,0	-	0,0	0,0	0,0	0,0	0,0	-	0,0	0,0	0,0	-	0,0	
		average	0,0	-	0,0	0,0	0,0	0,0	0,0	-	0,0	0,0	0,0	-	0,0	
		max	0,0	-	0,0	0,0	0,0	0,0	0,0	-	0,0	0,0	0,0	-	0,0	
	MUH	min	0,0	-	0,0	0,0	0,0	0,0	0,0	-	0,0	0,0	-	-	0,0	
		average	0,0	-	0,0	0,0	0,0	0,0	0,0	-	0,0	0,0	-	-	0,0	
		max	0,0	-	0,0	0,0	0,0	0,0	0,0	-	0,0	0,0	-	-	0,0	
	deviation from "common"															
C_NoCirc	SUH	min	0,2	0,0	0,4	0,4	-	0,0	0,1	-	-	0,6	0,0	0,0	0,2	-54%
		average	0,2	1,5	0,4	0,4	-	0,0	0,3	-	-	0,6	0,0	0,0	0,4	
		max	0,2	3,1	0,4	0,4	-	0,0	0,4	-	-	0,6	0,0	0,0	0,8	+122%
	MUH	min	0,2	0,0	0,4	0,2	-	0,0	0,1	-	-	-	-	-	0,1	-69%
		average	0,2	1,5	0,4	0,2	-	0,0	0,3	-	-	-	-	-	0,4	+14%
		max	0,2	3,1	0,4	0,2	-	0,0	0,4	-	-	-	-	-	1,1	+151%
	deviation from "common"		-49%	+273%	+1%	-24%		-100%	-37%							
C_Circ	SUH	min	0,9	-	1,6	1,4	-	-	0,2	-	3,2	1,4	-	1,7	1,3	-19%
		average	0,9	-	1,6	1,4	-	-	0,4	-	4,1	1,4	-	1,7	1,6	
		max	0,9	-	1,6	1,4	-	-	0,6	-	4,6	1,4	-	1,7	2,1	+28%
	MUH	min	0,9	-	1,2	0,8	-	0,0	0,2	-	2,0	1,4	0,7	1,7	0,9	-19%
		average	0,9	-	1,2	0,8	-	0,0	0,4	-	2,4	1,4	1,1	1,7	1,1	-33%
		max	0,9	-	1,2	0,8	-	0,0	0,6	-	2,8	1,4	1,4	1,7	1,4	+24%
	deviation from "common"		-34%		+2%	-20%			-71%		+138%	+2%		+24%		
C_NoCirc_Sol	SUH	min	1,3	2,5	-	1,2	0,8	0,0	0,5	-	-	-	0,4	-	0,8	-18%
		average	1,3	2,5	-	1,2	0,9	0,0	0,9	-	-	-	0,5	-	1,0	
		max	1,3	2,5	-	1,2	0,9	0,0	1,2	-	-	-	0,5	-	1,3	+24%
	MUH	min	1,3	2,5	-	0,6	0,8	-	0,5	-	-	-	-	-	1,0	-15%
		average	1,3	2,5	-	0,6	0,9	-	0,9	-	-	-	-	-	1,2	+19%
		max	1,3	2,5	-	0,6	0,9	-	1,2	-	-	-	-	-	1,5	+23%
	deviation from "common"		+16%	+123%		-20%	-24%		-24%							
C_Circ_Sol	SUH	min	-	4,7	2,5	2,2	-	-	0,7	-	4,1	1,4	-	-	2,3	-16%
		average	-	4,7	2,5	2,2	-	-	1,3	-	4,5	1,4	-	-	2,8	
		max	-	4,7	2,5	2,2	-	-	1,9	-	4,9	1,4	-	-	3,2	+16%
	MUH	min	-	4,7	1,5	1,3	-	-	0,7	-	2,2	1,4	1,6	-	1,8	-15%
		average	-	4,7	1,5	1,3	-	-	1,3	-	2,4	1,4	2,0	-	2,1	-25%
		max	-	4,7	1,5	1,3	-	-	1,9	-	2,5	1,4	2,3	-	2,5	+23%
	deviation from "common"			+94%	-17%	-28%			-46%		+42%	-42%				

Table 44: Deviations from averages ("common values") per country

	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI
D												
C_NoCirc	-49%	+273%	+1%	-24%		-100%	-37%					
C_Circ	-34%		+2%	-20%			-71%		+138%	+2%		+24%
C_NoCirc_Sol	+16%	+123%		-20%	-24%		-24%					
C_Circ_Sol		+94%	-17%	-28%			-46%		+42%	-42%		

Table 45: Annual auxiliary electricity demand of DHW systems / merged and condensed values

dhw system type		energy efficiency	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common
D	decentral DHW system	poor	0,0		0,0	0,0	0,0	0,0	0,0		0,0	0,0	0,0		0,0
		medium	0,0		0,0	0,0	0,0	0,0	0,0		0,0	0,0	0,0		0,0
		high	0,0		0,0	0,0	0,0	0,0	0,0		0,0	0,0	0,0		0,0
	consideration in "common"		1		1	1	1		1		1	1	1		n=8
C_NoCirc	central DHW system, no circulation	poor	0,2	3,1	0,4	0,4		0,0	0,4			0,6	0,0	0,0	1,9
		medium	0,2	1,5	0,4	0,3		0,0	0,3			0,6	0,0	0,0	0,4
		high	0,2	0,0	0,4	0,2		0,0	0,1			0,6	0,0	0,0	0,1
	consideration in "common"		1	1	1	1			1			1	1	1	n=8
C_Circ	central DHW system with circulation	poor	0,9		1,6	1,4		0,0	0,6		4,6	1,4	1,4	1,7	3,2
		medium	0,9		1,4	1,1		0,0	0,4		3,3	1,4	1,1	1,7	1,4
		high	0,9		1,2	0,8		0,0	0,2		2,0	1,4	0,7	1,7	0,7
	consideration in "common"		1		1	1			1		1	1	1	1	n=8
C_NoCirc_Sol	central DHW system with solar thermal system, no circulation	poor	1,3	2,5		1,2	0,9	0,0	1,2				0,5		1,9
		medium	1,3	2,5		0,9	0,9	0,0	0,9				0,5		1,1
		high	1,3	2,5		0,6	0,8	0,0	0,5				0,4		0,7
	consideration in "common"		1	1		1	1		1				1		n=6
C_Circ_Sol	central DHW system with solar thermal system and circulation	poor		4,7	2,5	2,2			1,9		4,9	1,4	2,3		3,9
		medium		4,7	2,0	1,8			1,3		3,4	1,4	2,0		2,4
		high		4,7	1,5	1,3			0,7		2,2	1,4	1,6		1,3
	consideration in "common"			1	1	1			1		1	1	1		n=7

Figure 22: **Annual auxiliary electricity demand of DHW systems /**
<D> decentral DHW system; <C_NoCirc> central DHW system, no circulation; <C_Circ> central DHW system with circulation; <C_NoCirc_Sol> central DHW system with solar thermal system, no circulation; <C_Circ_Sol> central DHW system with solar thermal system and circulation

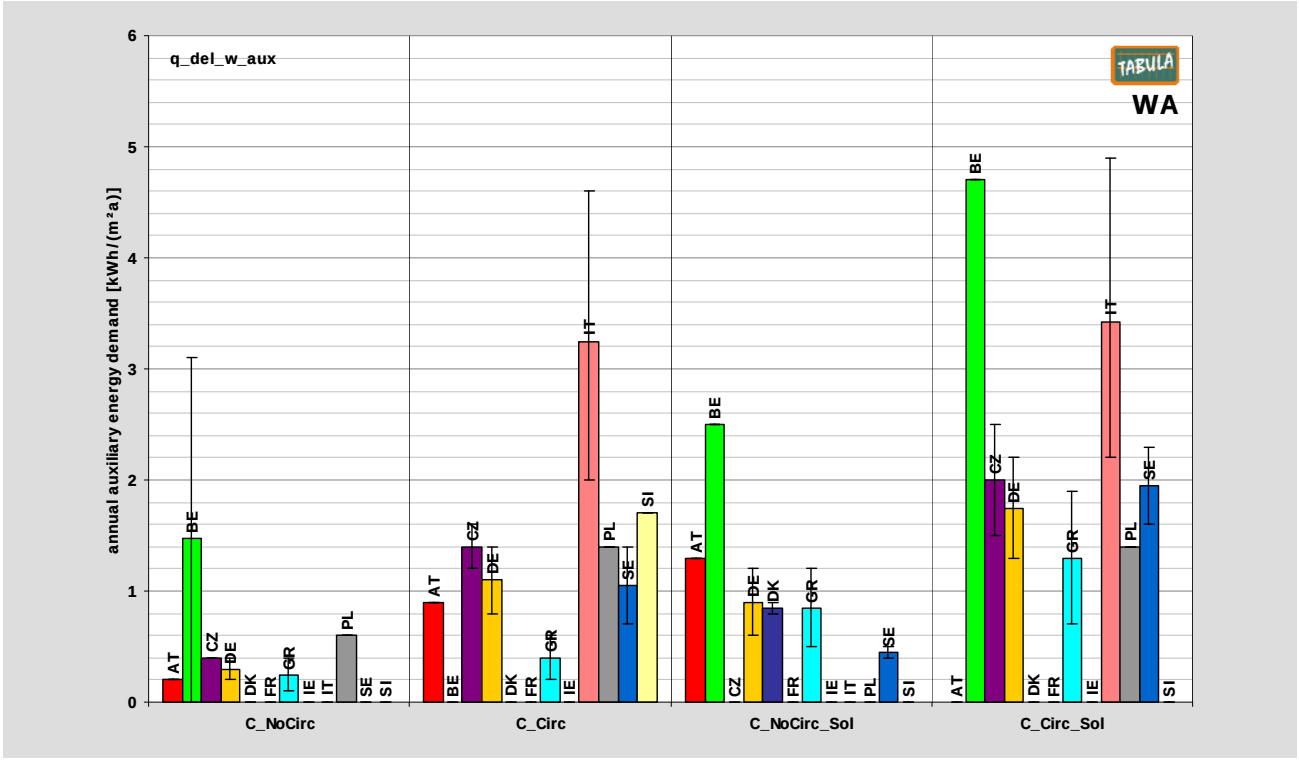


Table 46: **Annual auxiliary electricity demand of DHW systems / derived default values (simplified common values)**

TABULA code	**description**	**auxiliary energy demand (electricity) of dhw systems**		
		annual values in kWh per m² reference area for heat generation (blower, control), storage (pump), distribution (pump), as far as available		
		$q_{del,w,aux}$		
		[kWh/(m²a)]		
	energy efficiency	**poor**	**medium**	**high**
D	decentral DHW system	0,0	0,0	0,0
C_NoCirc	central DHW system, no circulation	1,9	0,4	0,1
C_Circ	central DHW system with circulation	3,2	1,4	0,7
C_NoCirc_Sol	central DHW system with solar thermal system, no circulation	1,9	1,1	0,7
C_Circ_Sol	central DHW system with solar thermal system and circulation	3,9	2,4	1,3

4.10 Vent – Ventilation Systems

Table 47: Fraction of ventilation heat losses recovered by ventilation systems differentiated by country and by building size class

			AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common	deviation
Exh	SUH	min	0,0	0,0	0,0	0,0	-	-	-	-	-	-	0,7	-	0,1	-17%
		average	0,0	0,0	0,0	0,0	-	-	-	-	-	-	0,7	-	0,1	
		max	0,0	0,0	0,0	0,0	-	-	-	-	-	-	0,7	-	0,2	+67%
	MUH	min	0,0	0,0	0,0	0,0	0,0	-	-	-	-	-	0,7	-	0,1	-14%
		average	0,0	0,0	0,0	0,0	0,0	-	-	-	-	-	0,7	-	0,1	-17%
		max	0,0	0,0	0,0	0,0	0,0	-	-	-	-	-	0,7	-	0,2	+71%
	deviation from "common"		-100%	-100%	-100%	-100%							+445%			
Bal	SUH	min	-	-	-	-	-	0,0	-	-	-	-	0,7	-	0,23	-50%
		average	-	-	-	-	-	0,2	-	-	-	-	0,7	-	0,46	
		max	-	-	-	-	-	0,9	-	-	-	-	0,7	-	0,83	+80%
	MUH	min	-	-	-	-	-	0,0	-	-	-	-	0,7	-	0,23	-50%
		average	-	-	-	-	-	0,2	-	-	-	-	0,7	-	0,46	0%
		max	-	-	-	-	-	0,9	-	-	-	-	0,7	-	0,83	+80%
	deviation from "common"							-51%					+51%			
Bal_Rec	SUH	min	0,6	0,8	0,6	0,6	0,6	-	-	0,9	-	0,6	-	0,8	0,67	-8%
		average	0,7	0,8	0,6	0,7	0,8	-	-	0,9	-	0,6	-	0,8	0,73	
		max	0,8	0,8	0,6	0,8	1,0	-	-	0,9	-	0,6	-	0,8	0,79	+9%
	MUH	min	0,6	0,8	0,6	0,6	0,6	-	-	0,9	-	0,6	-	0,8	0,67	-8%
		average	0,7	0,8	0,6	0,7	0,8	-	-	0,9	-	0,6	-	0,8	0,73	-0%
		max	0,8	0,8	0,6	0,8	0,9	-	-	0,9	-	0,6	-	0,8	0,78	+8%
	deviation from "common"		-4%	+10%	-17%	-4%	+5%			+24%		-24%		+10%		
Bal_GroundRec	SUH	min	-	-	-	0,9	-	-	-	-	-	-	-	-	0,90	0%
		average	-	-	-	0,9	-	-	-	-	-	-	-	-	0,90	
		max	-	-	-	0,9	-	-	-	-	-	-	-	-	0,90	0%
	MUH	min	-	-	-	0,9	-	-	-	-	-	-	-	-	0,90	0%
		average	-	-	-	0,9	-	-	-	-	-	-	-	-	0,90	0%
		max	-	-	-	0,9	-	-	-	-	-	-	-	-	0,90	0%
	deviation from "common"					0%										

Table 48: Annual auxiliary electricity demand of ventilation systems differentiated by country and by building size class

			AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common	deviation
Exh	SUH	min	1,1	1,2	1,1	1,1	-	-	-	-	-	-	2,0	-	1,3	-3%
		average	1,1	1,2	1,1	1,1	-	-	-	-	-	-	2,0	-	1,3	
		max	1,1	1,2	1,1	1,1	-	-	-	-	-	-	2,0	-	1,4	+9%
	MUH	min	1,1	1,2	1,1	1,1	7,6	-	-	-	-	-	2,0	-	2,2	-8%
		average	1,1	1,2	1,1	1,1	7,6	-	-	-	-	-	2,0	-	2,4	+81%
		max	1,1	1,2	1,1	1,1	7,6	-	-	-	-	-	2,0	-	3,1	+32%
	deviation from "common"		-40%	-34%	-40%	-40%							+10%			
Bal	SUH	min	-	-	-	-	-	1,3	-	-	-	-	2,0	-	1,54	-30%
		average	-	-	-	-	-	2,4	-	-	-	-	2,0	-	2,19	
		max	-	-	-	-	-	3,7	-	-	-	-	2,0	-	3,16	+44%
	MUH	min	-	-	-	-	-	1,3	-	-	-	-	2,0	-	1,54	-30%
		average	-	-	-	-	-	2,4	-	-	-	-	2,0	-	2,19	0%
		max	-	-	-	-	-	3,7	-	-	-	-	2,0	-	3,16	+44%
	deviation from "common"							+9%					-9%			
Bal_Rec	SUH	min	1,7	2,7	2,1	1,7	3,0	-	-	2,8	-	1,8	-	2,0	2,16	-11%
		average	2,2	2,7	2,1	2,2	3,8	-	-	2,8	-	1,8	-	2,0	2,43	
		max	2,6	2,7	2,1	2,6	4,6	-	-	2,8	-	1,8	-	2,0	2,85	+17%
	MUH	min	1,7	2,7	2,1	1,7	4,6	-	-	2,8	-	1,8	-	2,0	2,33	-14%
		average	2,2	2,7	2,1	2,2	6,1	-	-	2,8	-	1,8	-	2,0	2,71	+12%
		max	2,6	2,7	2,1	2,6	7,6	-	-	2,8	-	1,8	-	2,0	3,52	+30%
	deviation from "common"		-16%	+5%	-18%	-16%	+93%			+7%		-32%		-22%		
Bal_GroundRec	SUH	min	-	-	-	2,6	-	-	-	-	-	-	-	-	2,60	0%
		average	-	-	-	2,6	-	-	-	-	-	-	-	-	2,60	
		max	-	-	-	2,6	-	-	-	-	-	-	-	-	2,60	0%
	MUH	min	-	-	-	2,6	-	-	-	-	-	-	-	-	2,60	0%
		average	-	-	-	2,6	-	-	-	-	-	-	-	-	2,60	0%
		max	-	-	-	2,6	-	-	-	-	-	-	-	-	2,60	0%
	deviation from "common"					0%										

Table 49: Deviations from averages ("common values") per country – recovered heat loss fraction

	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI
Exh	-100%	-100%	-100%	-100%							+445%	
Bal						-51%					+51%	
Bal_Rec	-4%	+10%	-17%	-4%	+5%			+24%		-24%		+10%
Bal_GroundRec				0%								

Table 50: Deviations from averages ("common values") per country – auxiliary energy demand

	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI
Exh	-40%	-34%	-40%	-40%							+10%	
Bal						+9%					-9%	
Bal_Rec	-16%	+5%	-18%	-16%	+93%			+7%		-32%		-22%
Bal_GroundRec				0%								

Table 51: Fraction of ventilation heat losses recovered by ventilation systems / merged and condensed values

ventilation system type		energy efficiency	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common
Exh	exhaust air system	poor	0,00	0,00	0,00	0,00	0,00						0,70		0,00
		medium	0,00	0,00	0,00	0,00	0,00						0,70		0,00
		high	0,00	0,00	0,00	0,00	0,00						0,70		0,00
	consideration in "common"		1	1	1	1	1								n=5
Bal	balanced ventilation system	poor						0,00					0,70		0,00
		medium						0,23					0,70		0,00
		high						0,90					0,70		0,00
	consideration in "common"														n=0
Bal_Rec	balanced ventilation system with heat recovery	poor	0,60	0,80	0,60	0,60	0,60			0,90		0,55		0,80	0,62
		medium	0,70	0,80	0,60	0,70	0,76			0,90		0,55		0,80	0,73
		high	0,80	0,80	0,60	0,80	0,90			0,90		0,55		0,80	0,83
	consideration in "common"		1	1	1	1	1			1		1		1	n=8
Bal_GroundRec	balanced ventilation system, preheated by ground heat exchanger + heat recovery	poor				0,90									0,90
		medium				0,90									0,90
		high				0,90									0,90
	consideration in "common"					1									n=1

Remarks

Determination of common values

Exh + Bal: FR + SE: not considered since values > 0 are not plausible

Table 52: Annual auxiliary electricity demand of ventilation systems / merged and condensed values

ventilation system type		energy efficiency	AT	BE	CZ	DE	DK	FR	GR	IE	IT	PL	SE	SI	common
Exh	exhaust air system	poor	1,1	1,2	1,1	1,1	7,6						2,0		1,7
		medium	1,1	1,2	1,1	1,1	7,6						2,0		1,3
		high	1,1	1,2	1,1	1,1	7,6						2,0		1,2
	consideration in "common"		1	1	1	1							1		n=5
Bal	balanced ventilation system	poor						3,7					2,0		3,3
		medium						2,4					2,0		2,2
		high						1,3					2,0		1,5
	consideration in "common"							1					1		n=2
Bal_Rec	balanced ventilation system with heat recovery	poor	2,6	2,7	2,1	2,6	7,6			2,8		1,8		2,0	5,3
		medium	2,2	2,7	2,1	2,2	4,9			2,8		1,8		2,0	2,6
		high	1,7	2,7	2,1	1,7	3,0			2,8		1,8		2,0	2,0
	consideration in "common"		1	1	1	1	1			1		1		1	n=8
Bal_GroundRec	balanced ventilation system, preheated by ground heat exchanger + heat recovery	poor				2,6									2,6
		medium				2,6									2,6
		high				2,6									2,6
	consideration in "common"					1									n=1

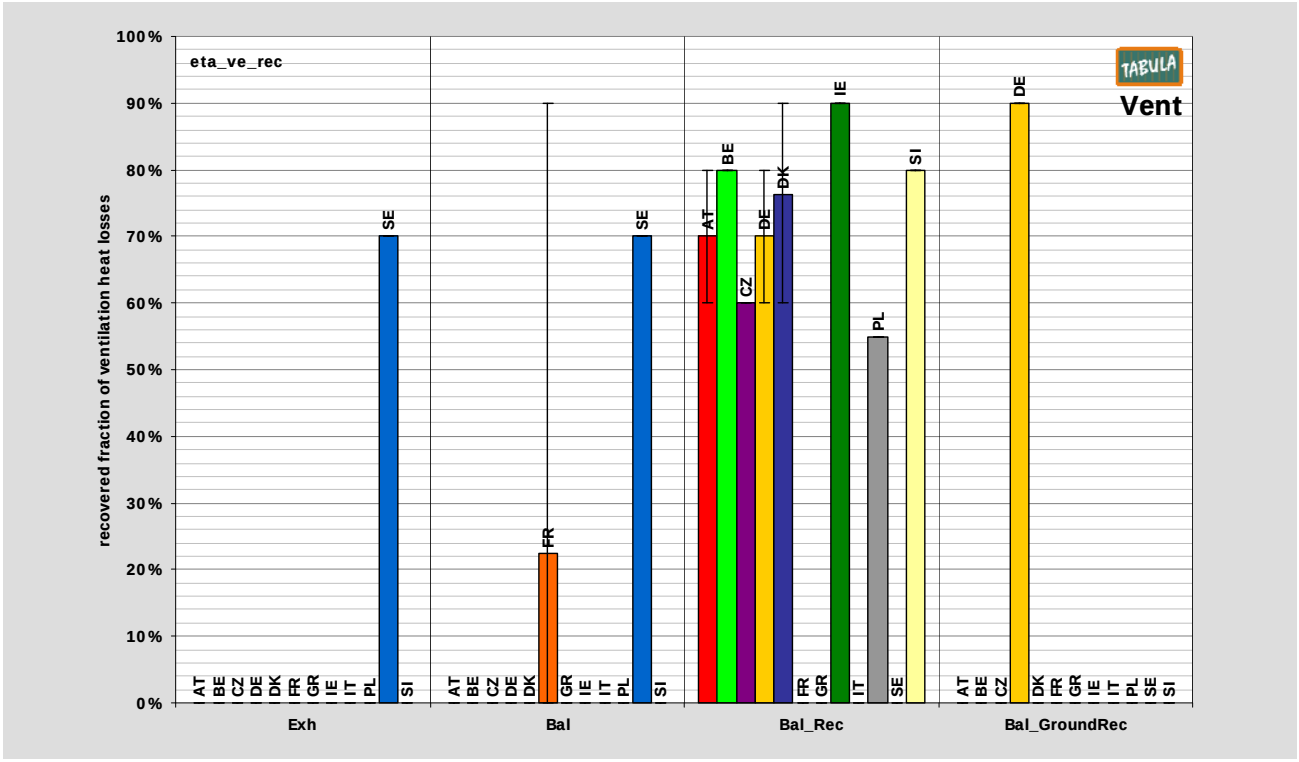
Remarks

Determination of common values

Exh DK: not considered (not plausible: values larger than / equal to balanced ventilation with heat recovery)

Figure 23: Recovered fraction of ventilation heat losses + annual auxiliary energy demand of ventilation systems

<Exh> exhaust air system; <Bal> balanced ventilation system; <Bal_Rec> balanced ventilation system with heat recovery; <Bal_GroundRec> balanced ventilation system, preheated by ground heat exchanger + heat recovery



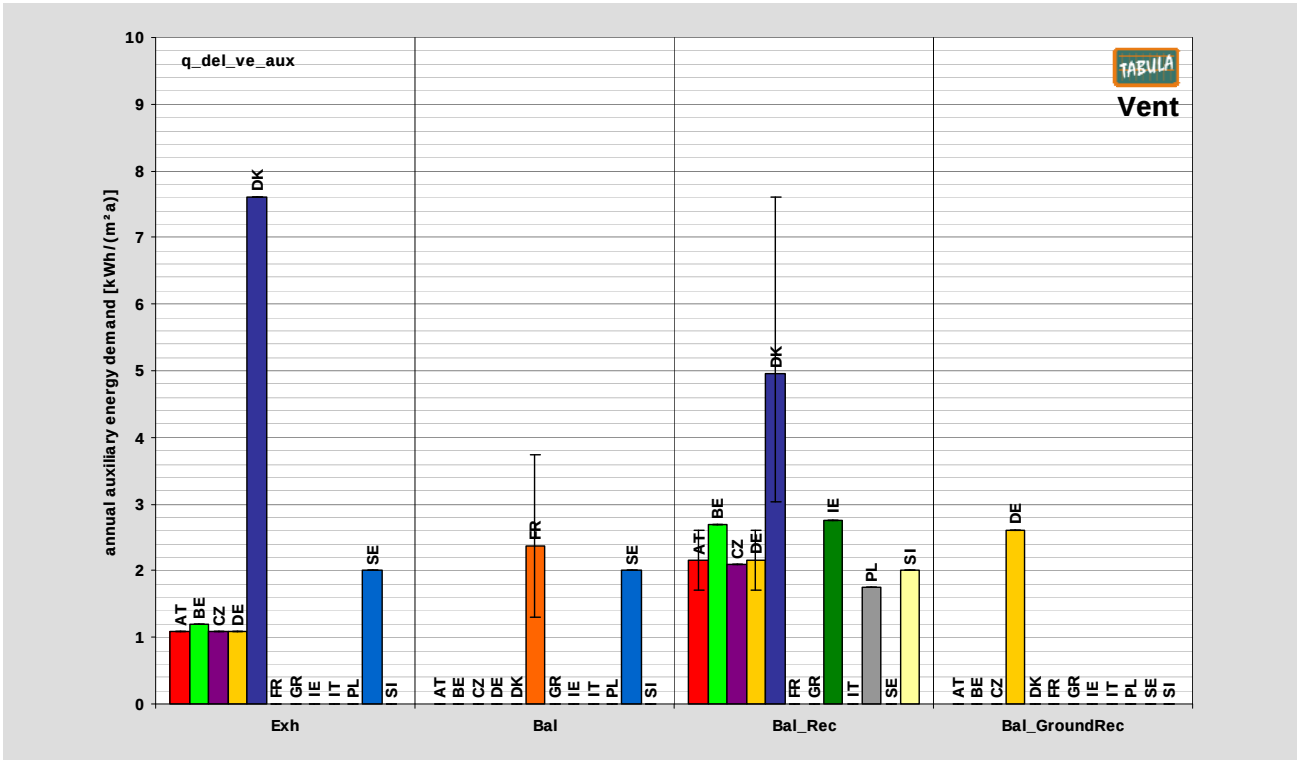


Table 53: Performance of ventilation systems / derived default values (simplified common values)

TABULA code	description	heat recovery by ventilation systems			auxiliary energy demand (electricity) of ventilation systems		
		overall performance ratio of heat recovery by the heat exchanger			annual values in kWh per m² reference area		
		$\eta_{ve,rec}$			$q_{del,ve,aux}$		
		[-]			[kWh/(m²a)]		
	energy efficiency	**poor**	**medium**	**high**	**poor**	**medium**	**high**
Exh	exhaust air system	0,00	0,00	0,00	1,7	1,3	1,2
Bal	balanced ventilation system	0,00	0,00	0,00	3,3	2,2	1,5
Bal_Rec	balanced ventilation system with heat recovery	0,62	0,73	0,83	5,3	2,6	2,0
Bal_GroundRec	balanced ventilation system, preheated by ground heat exchanger + heat recovery	0,90	0,90	0,90	2,6	2,6	2,6

5 Résumé

The evaluation of the TABULA database provided a number of important insights and findings and will be the basis for a further development in different directions:

- **Feedback of data input**

  The comparison with other countries gives indications of unclear definitions or data input errors. This may prompt TABULA partners to check and maybe revise their input or to provide supplemental data.

- **Means for introducing and improving the quality assurance**

  The analysis of the variation of the quantities enables the definition and assignment of plausibility limits. These can in the future be used for an introduction of quality assurance procedures which enable an immediate control of plausibility in the phase of data entering.

  These QA mechanisms can of course also serve for plausibility controls on national level (e.g. during EPC issuing).

- **Selection of measures for Refurbishment Packages 1 and 2:**

  The rules for the definition of refurbishment packages on the two levels are until now rather vague (RP1 / Standard: "commonly realised during renovation"; RP2 / Advanced: "usually only realised in very ambitious renovations or research projects"). However, a cross-country comparison and discussion of energy upgrade quality is a very important task for the future. During the further development of the approach a justification for the fixing of these standards should be provided by each partner.

- **Utilisation of the averages / default values for simplified assessment of building portfolios and stocks:**

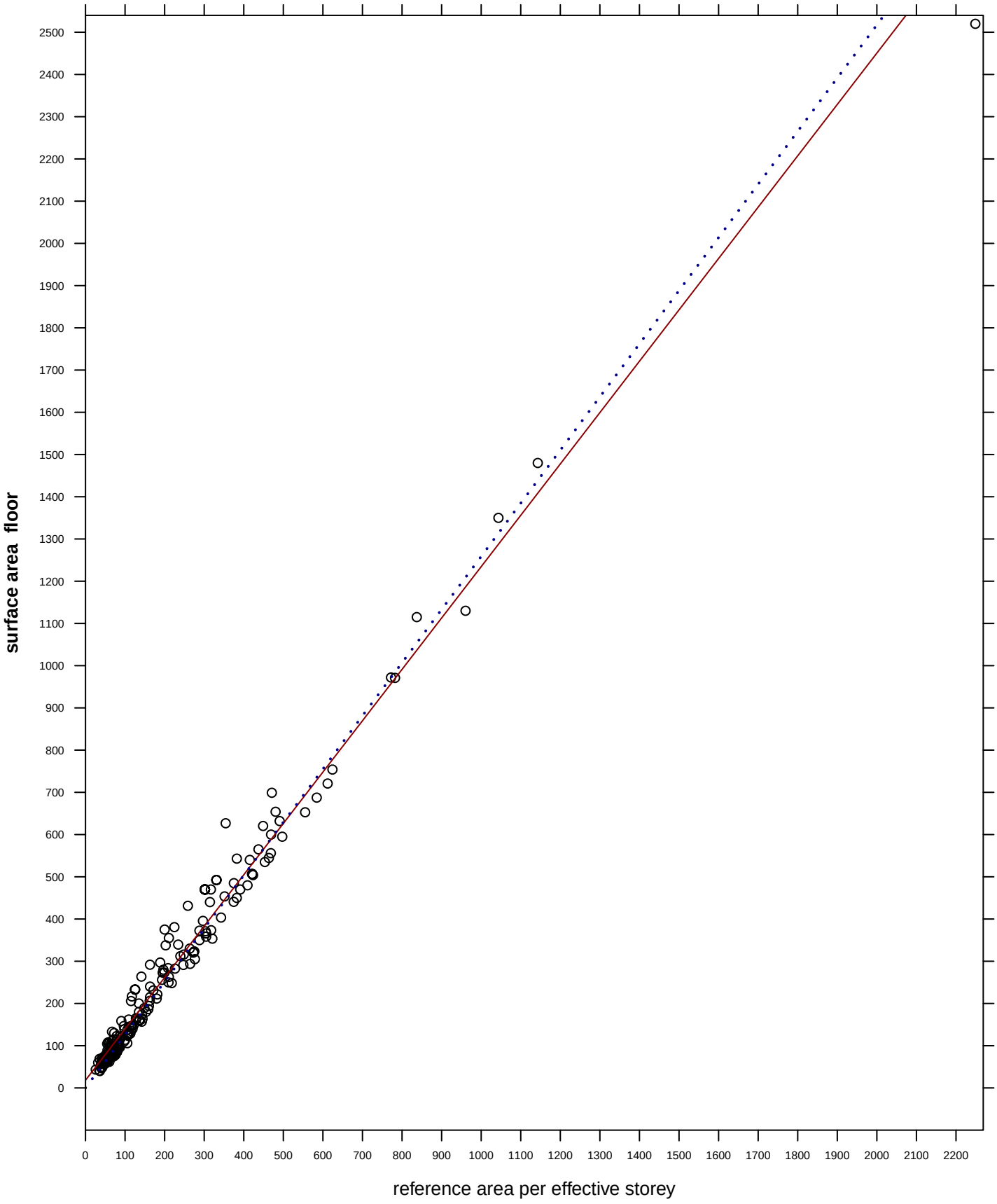
  The analyses of the TABULA database delivered a number of average or default values for envelope and supply system components as well as dependencies of the thermal envelope area on certain basic parameters. Apart from quality assurance procedures these findings also offer the possibility of a simplified assessment of housing portfolios and stocks. The data acquisition would be reduced to the following intake quantities:

  - thermal envelope area: living space, number of storeys, number of attached neighbour buildings, utilisation state of attic and cellar;
  - U-values: construction year (class), structure type, type of windows, later applied insulation measures (insulation thickness and renovated area fraction)
  - supply system: type of energy carrier, heat generator, storage, distribution (for space heating and dhw).

  Starting from these data energy balance calculations can be performed that deliver a rough estimate of the energy quality of the housing portfolio or stock and (in case that the typical relation of measured and calculated consumption is known) also an estimation value of the energy consumption by energy carrier. Vice versa, if the measured consumption is known for a specific building the above mentioned intake quantities enable an allocation of the actual heat losses and an estimation of the possible energy savings by distinct measures (recommendations for operational rating).

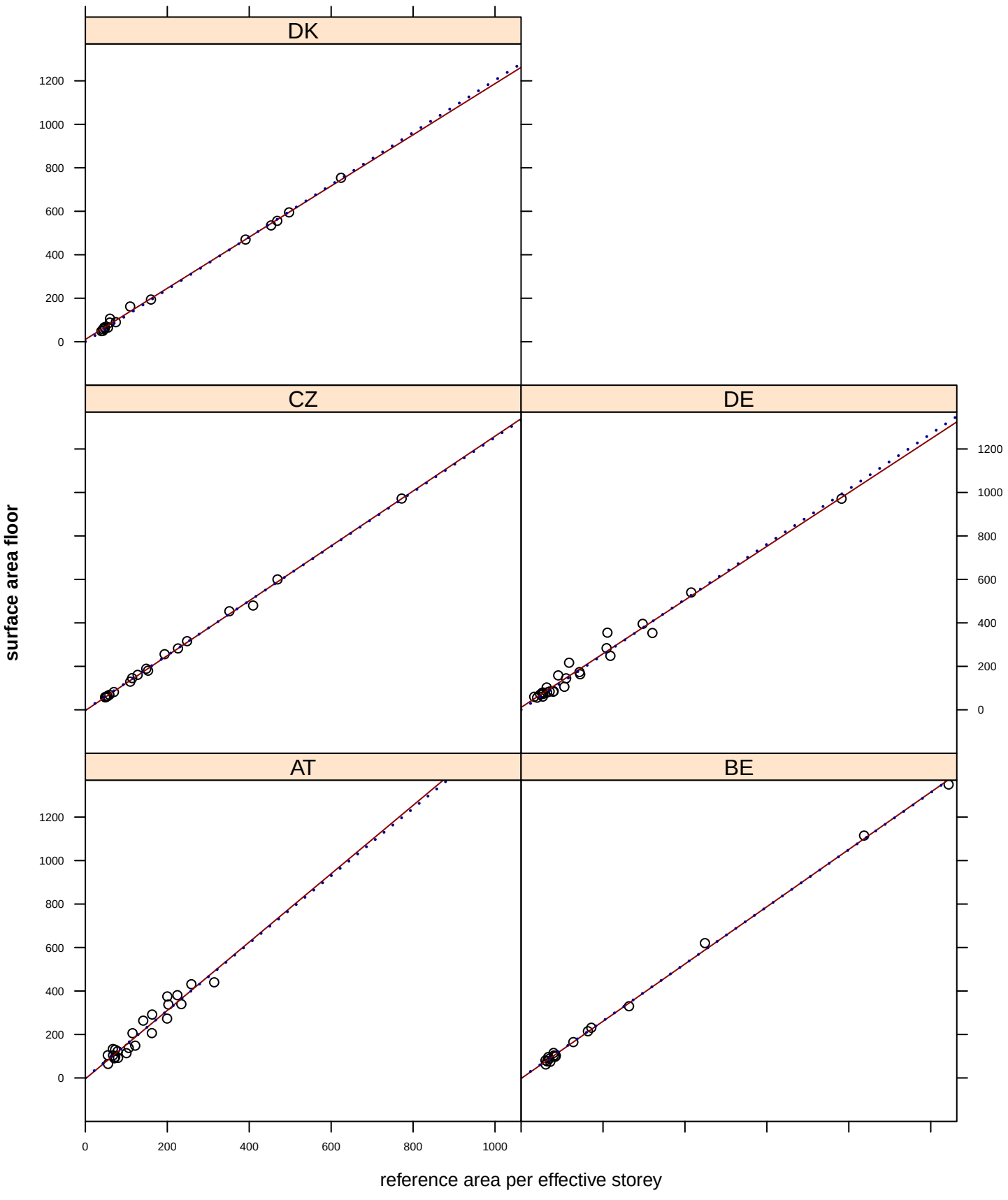
Appendix A – Thermal Envelope Area Analysis Report

surface area floor ~ reference area per effective storey (n= 271)
R^2 = 0.97 ,b = 18.1 , m = 1.21

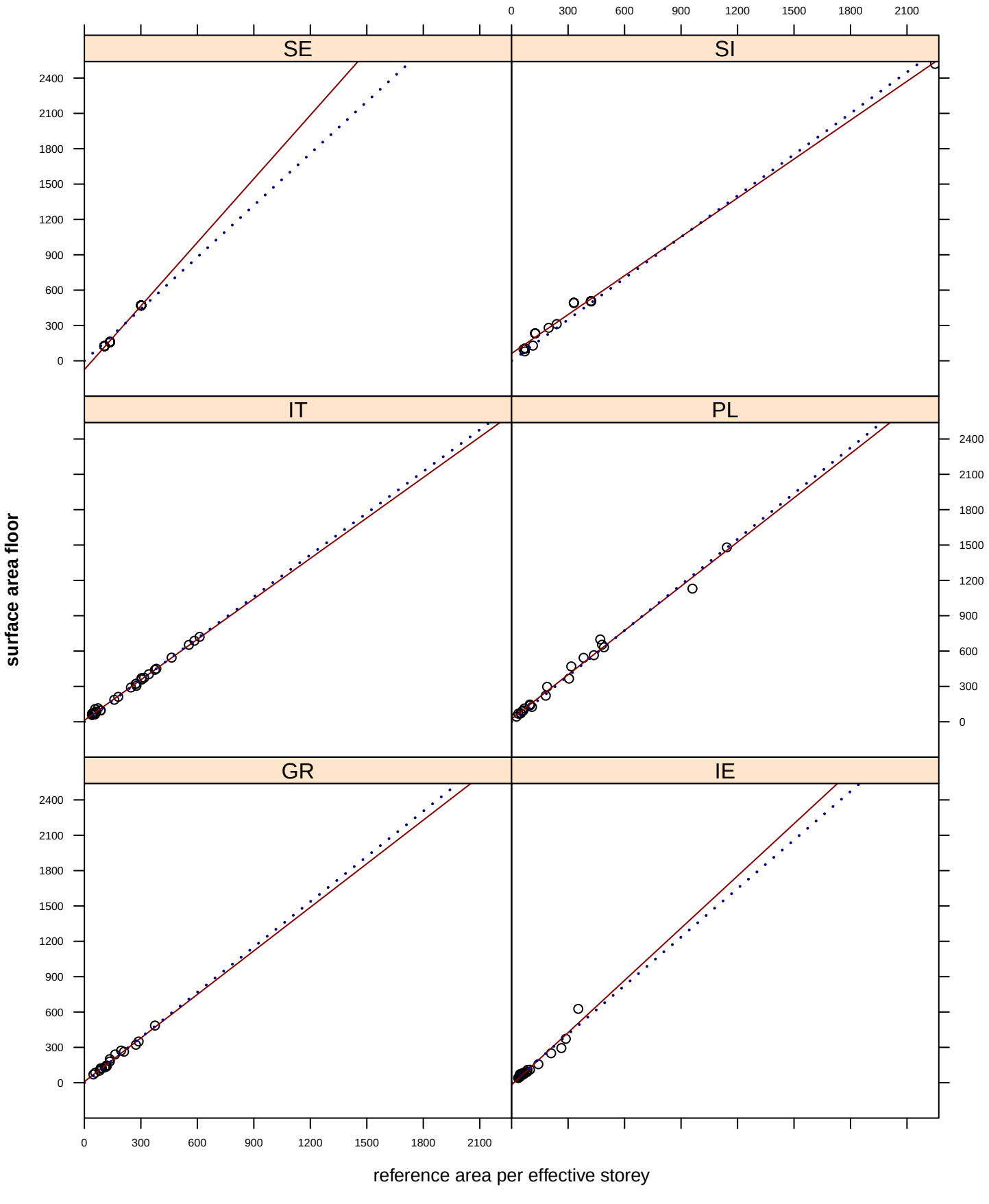


(Dotted = zero crossing: R^2 = 0.98 , m = 1.25)

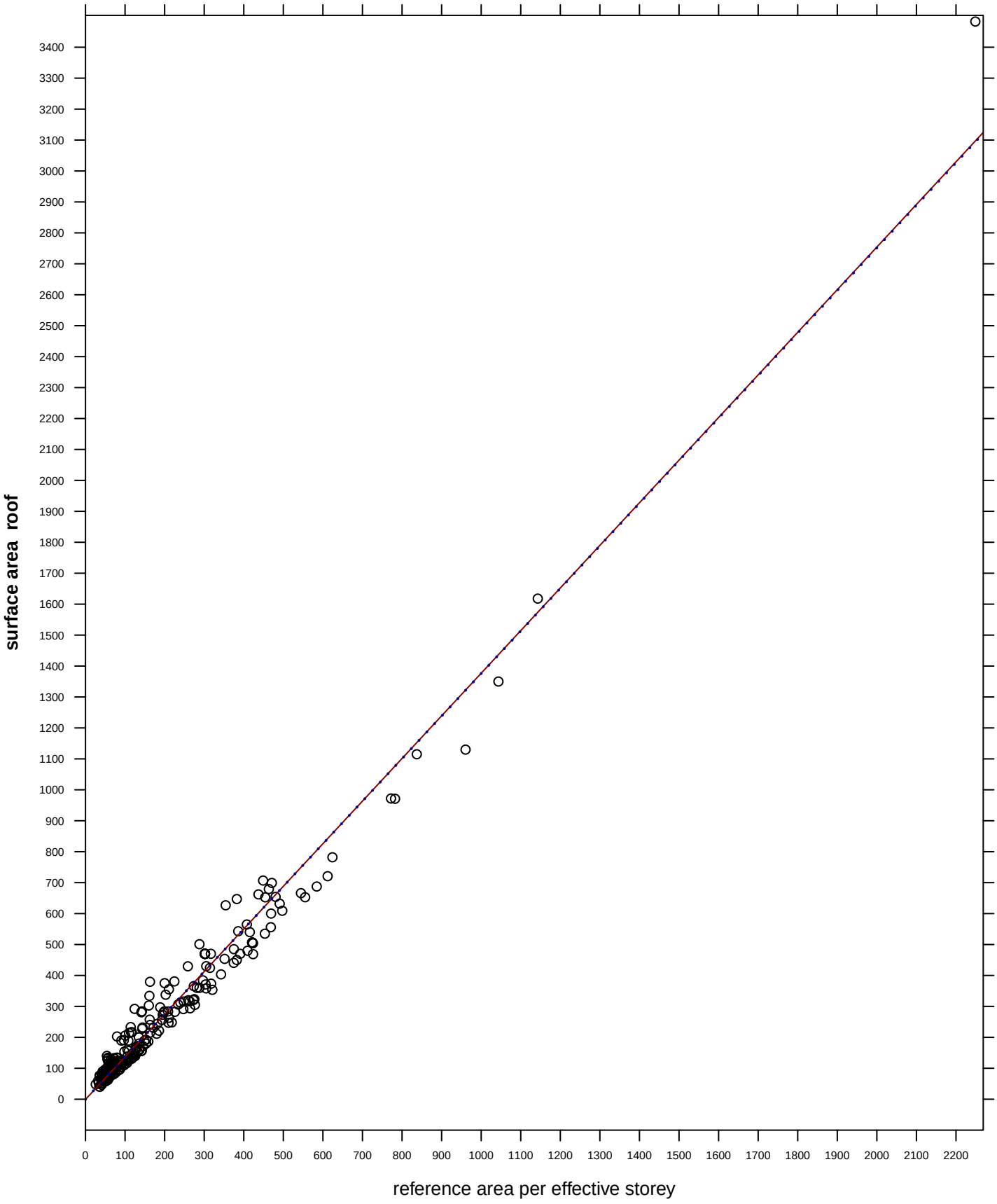
surface area floor ~ reference area per effective storey
by countries I



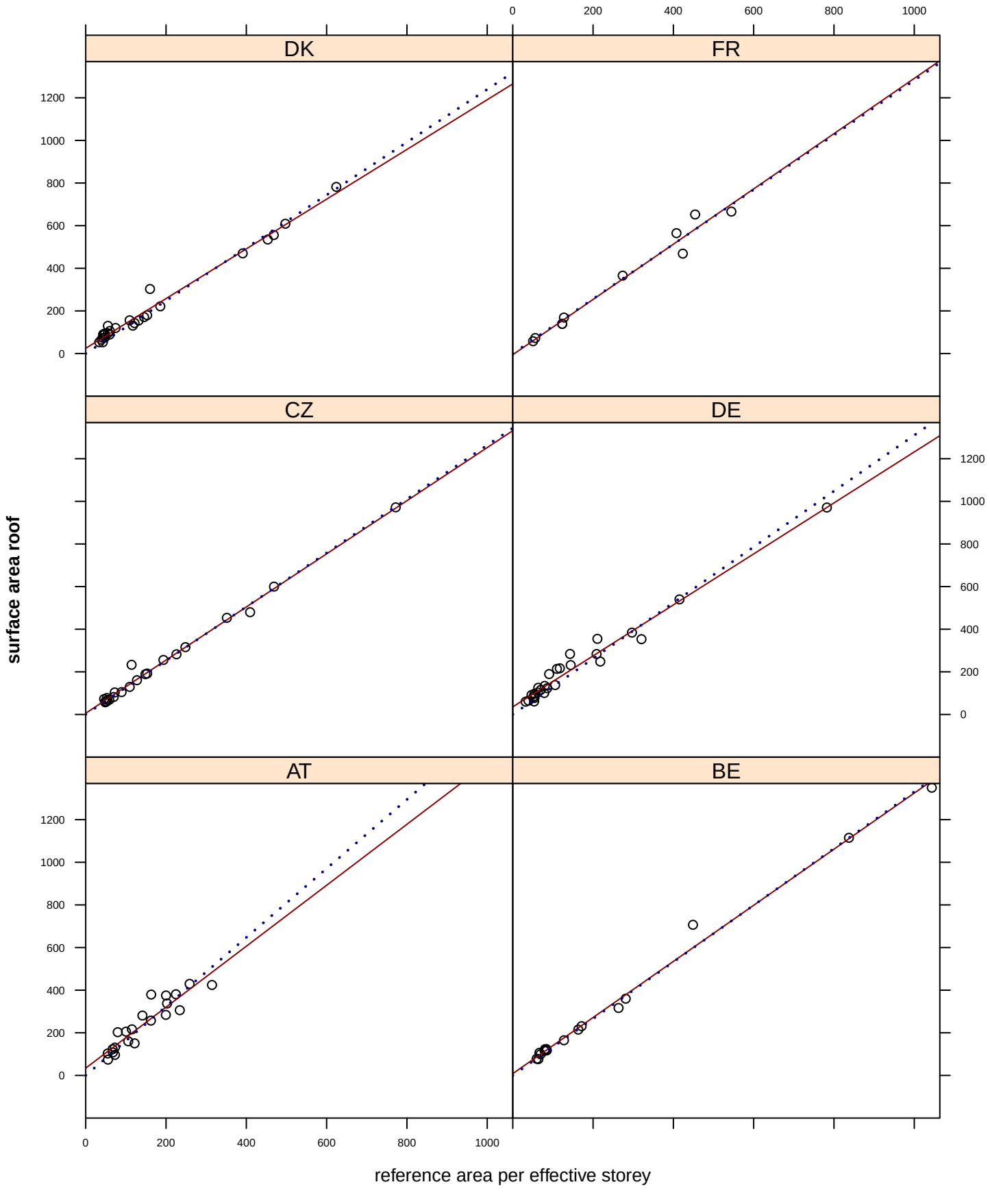
Dotted: With zero crossing

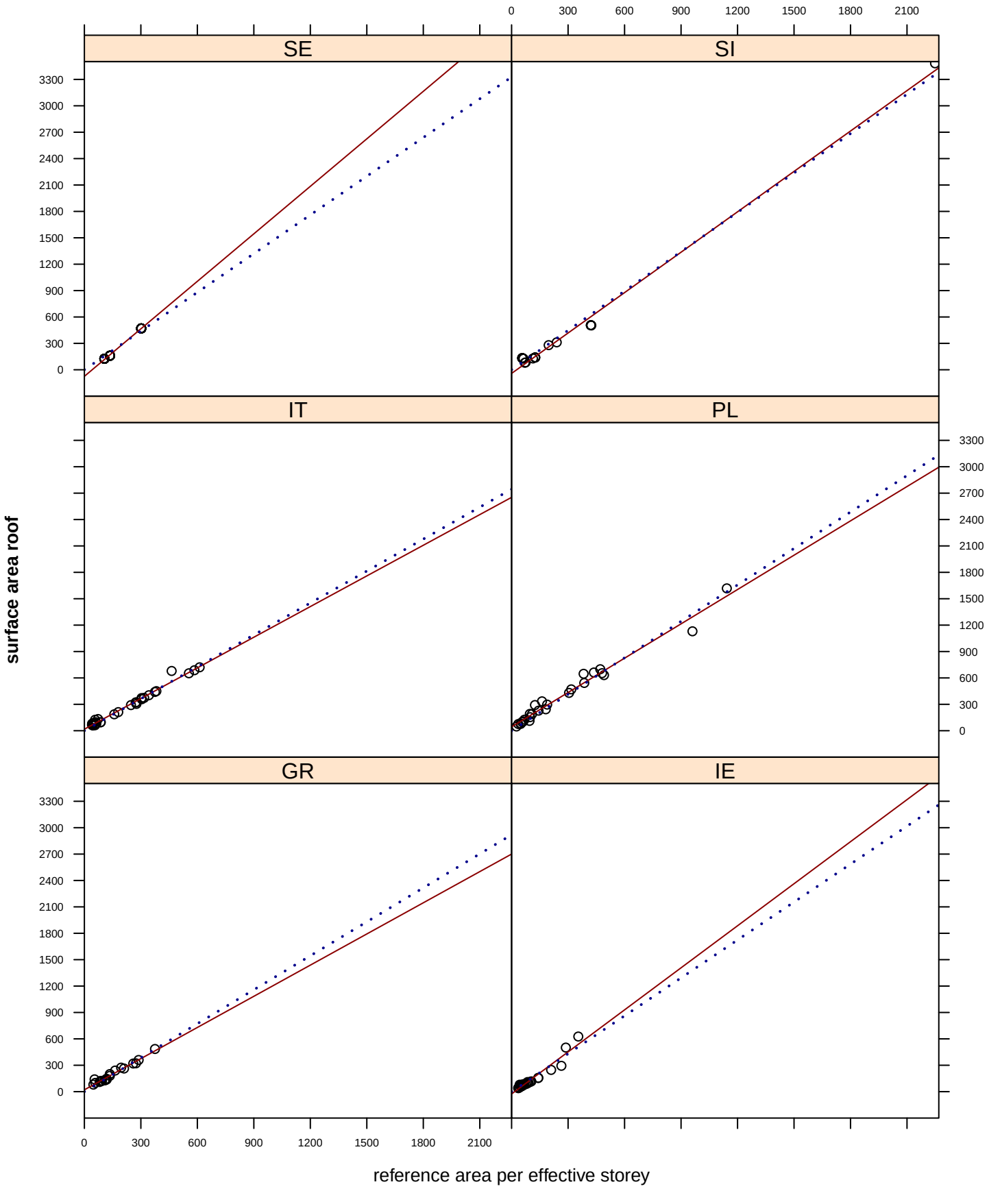

surface area floor ~ reference area per effective storey
by countries II
SE
SI
IT
PL
GR
IE
surface area floor
reference area per effective storey
0
300
600
900
1200
1500
1800
2100
2400
Dotted: With zero crossing

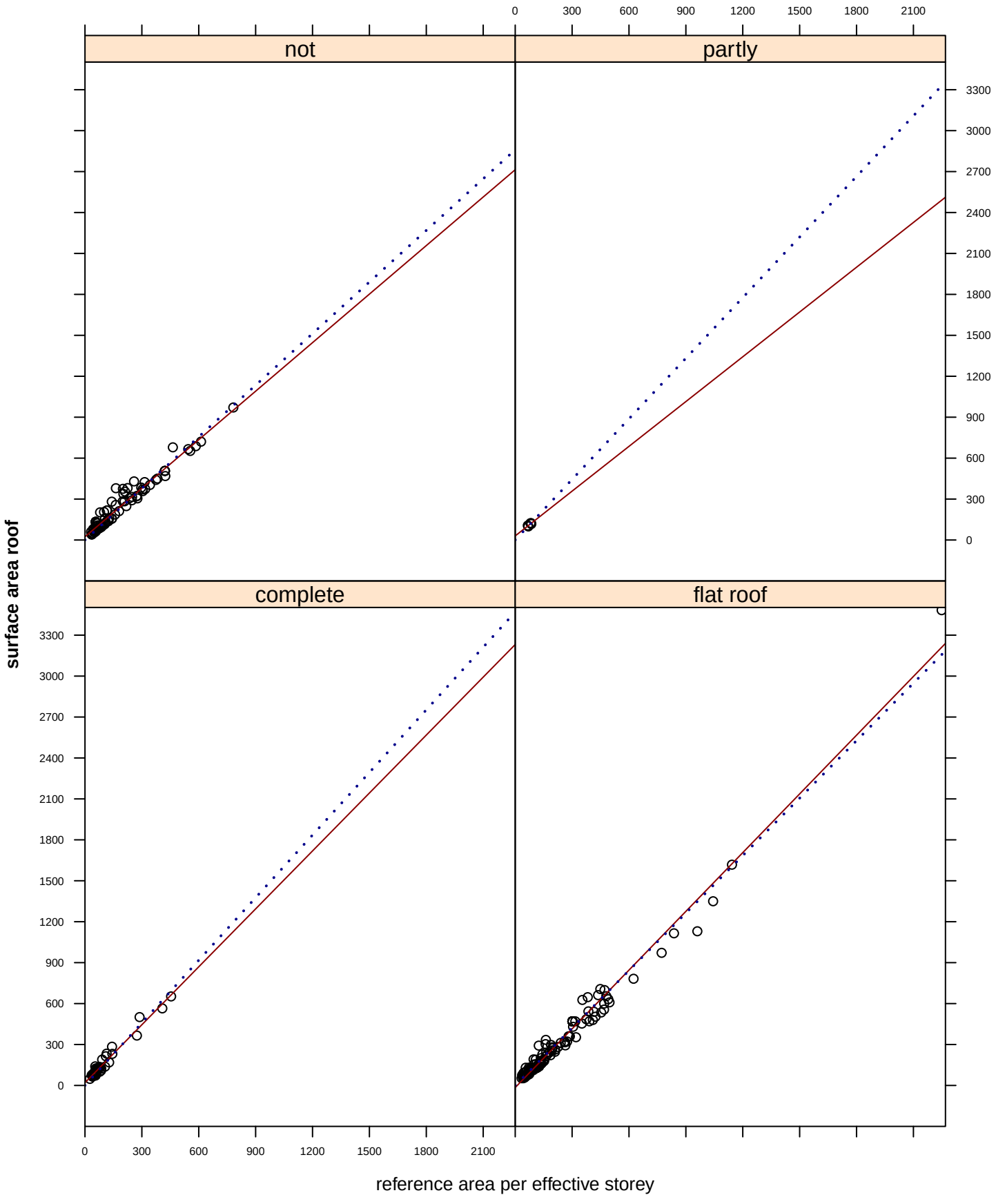
surface area roof ~ reference area per effective storey (n= 298)
R^2 = 0.96 ,b = −0.6 , m = 1.37



(Dotted = zero crossing: R^2 = 0.98 , m = 1.37)


surface area roof ~ reference area per effective storey
by countries I
DK
FR
CZ
DE
AT
BE
surface area roof
reference area per effective storey
0
200
400
600
800
1000
1200
Dotted: With zero crossing


surface area roof ~ reference area per effective storey
by countries II
SE
SI
IT
PL
GR
IE
surface area roof
reference area per effective storey
0
300
600
900
1200
1500
1800
2100
2400
2700
3000
3300
Dotted: With zero crossing

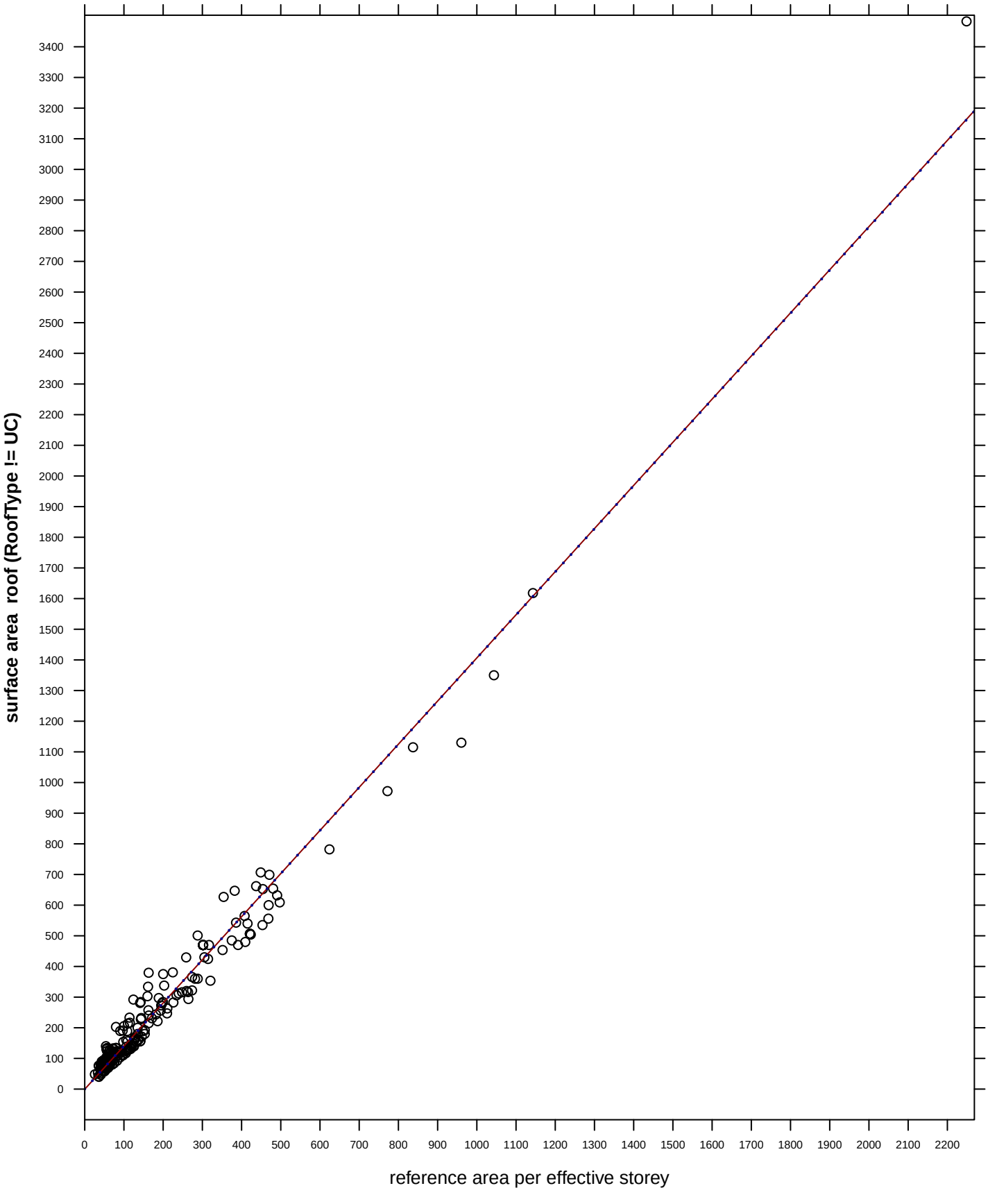

surface area roof ~ reference area per effective storey
by attic conditioned
not
partly
complete
flat roof
surface area roof
reference area per effective storey
0
300
600
900
1200
1500
1800
2100
2400
2700
3000
3300
Dotted: With zero crossing

Intercept, slope and R^2, slope and R^2 at zerocrossing

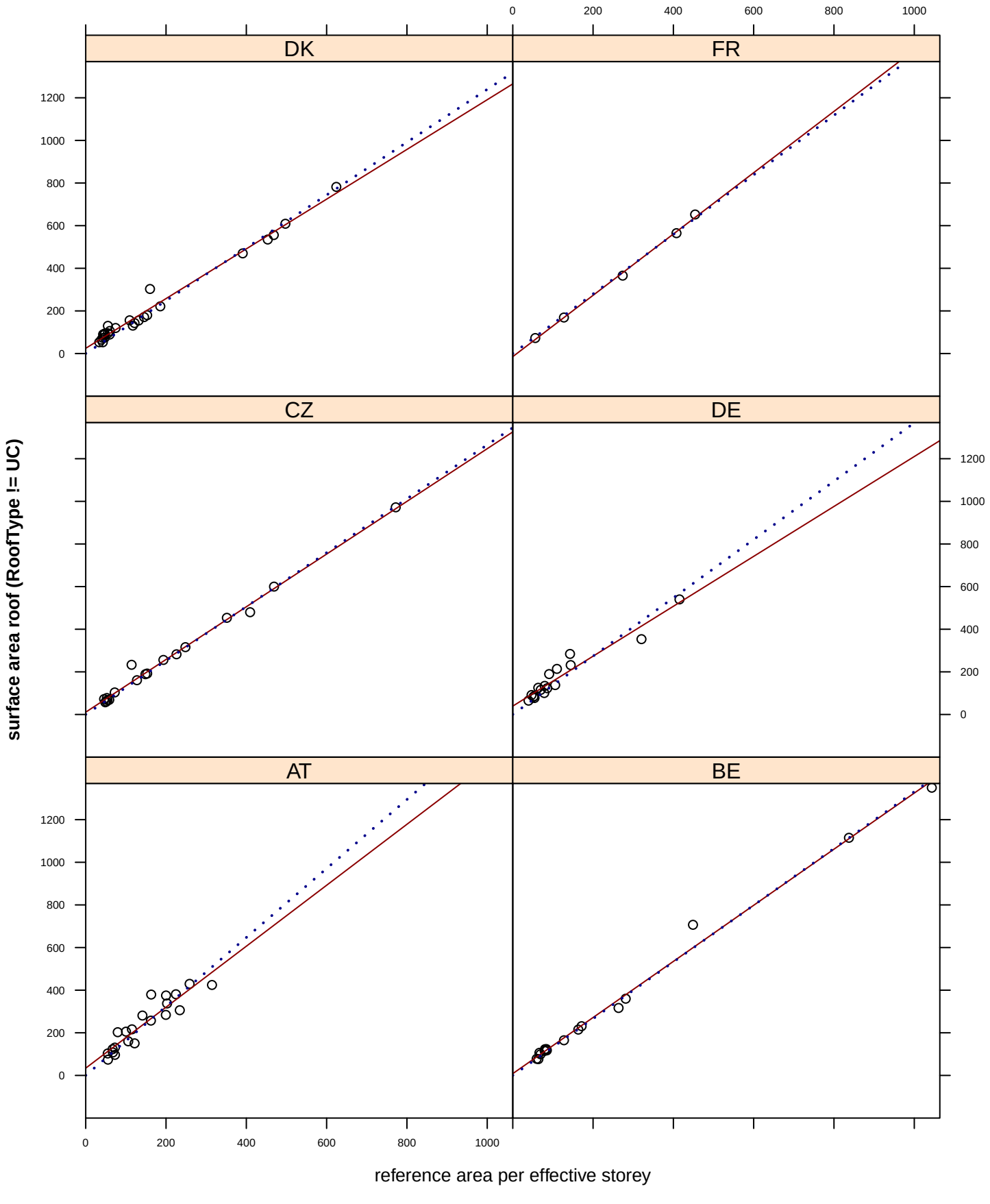
surface area roof ~ reference area per effective storey
by attic conditioned

	b	m	R^2	0_m	0_R^2	n
A_Roof: not conditioned	23.47	1.186	0.953	1.261	0.978	94
A_Roof: partly conditioned	29.971	1.094	0.756	1.48	0.998	5
A_Roof: completely conditioned	20.288	1.415	0.964	1.529	0.98	46
A_Roof: flat roof	−15.322	1.435	0.978	1.404	0.987	153

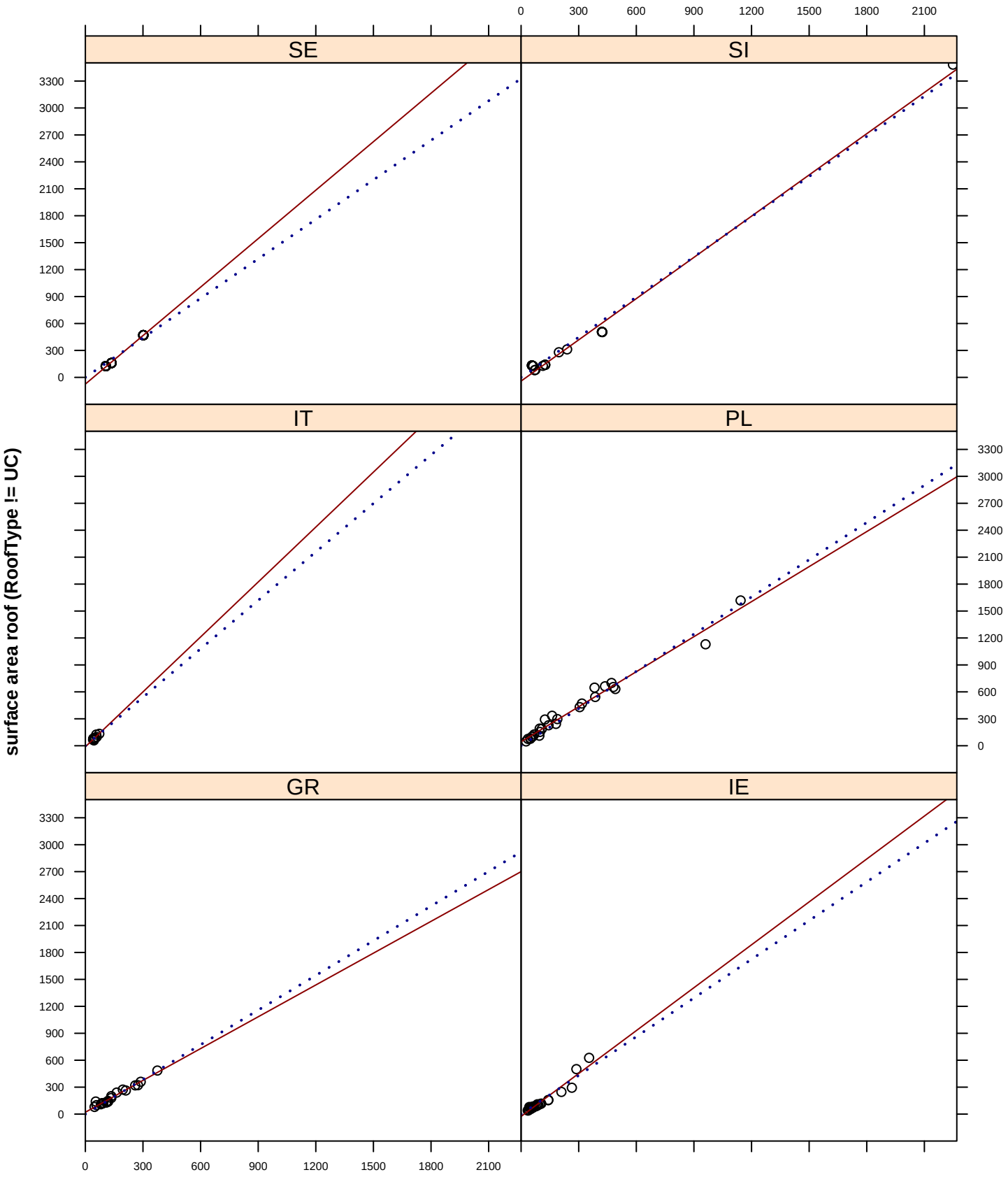
surface area roof (RoofType != UC) ~ reference area per effective storey (n= 257)
R^2 = 0.97 ,b = −0.3 , m = 1.40



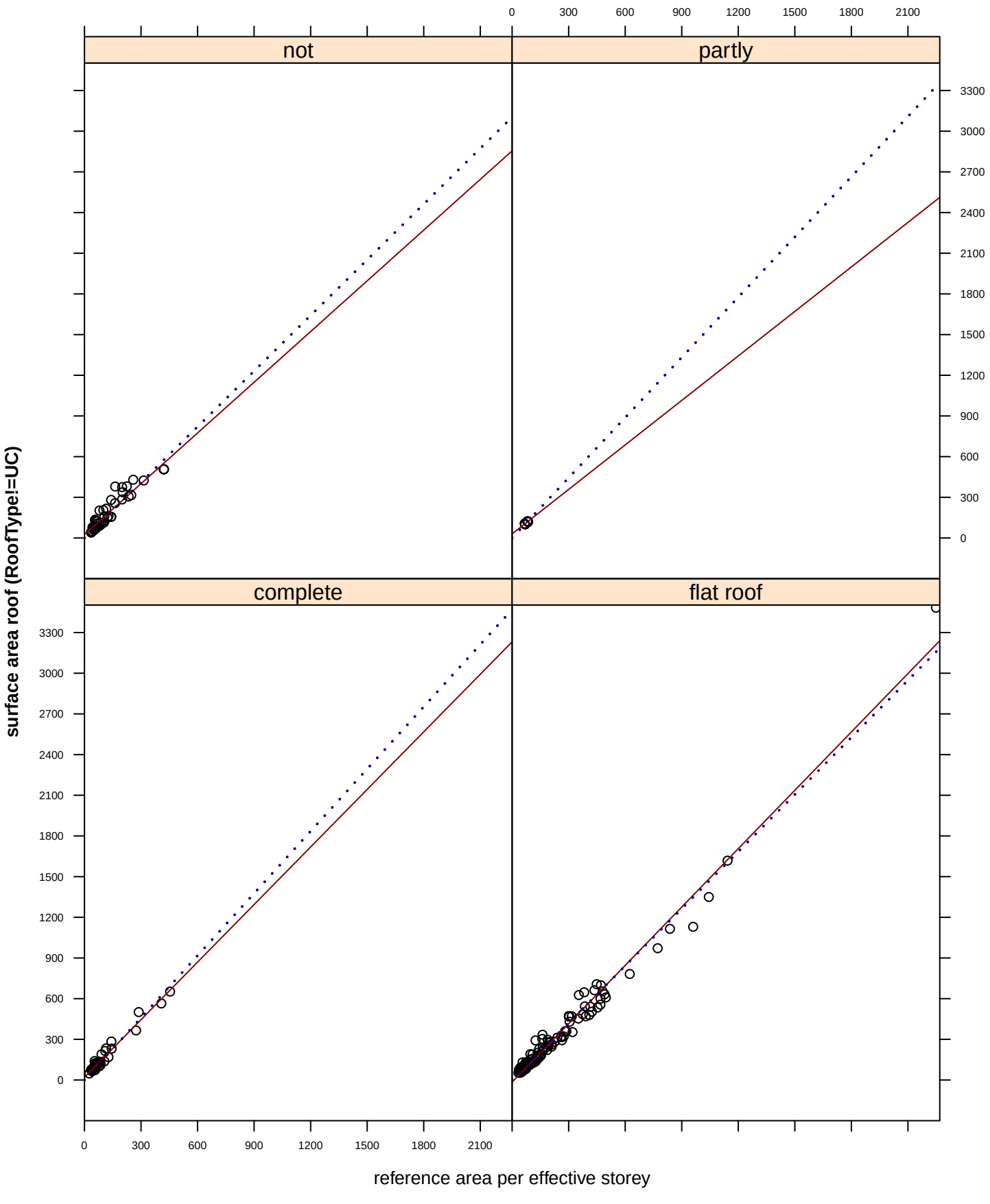
(Dotted = zero crossing: R^2 = 0.98 , m = 1.40)


surface area roof (RoofType != UC) ~ reference area per effective storey
by countries I
DK
FR
CZ
DE
AT
BE
surface area roof (RoofType != UC)
reference area per effective storey
0
200
400
600
800
1000
1200
Dotted: With zero crossing

surface area roof (RoofType != UC) ~ reference area per effective storey
by countries II



Dotted: With zero crossing

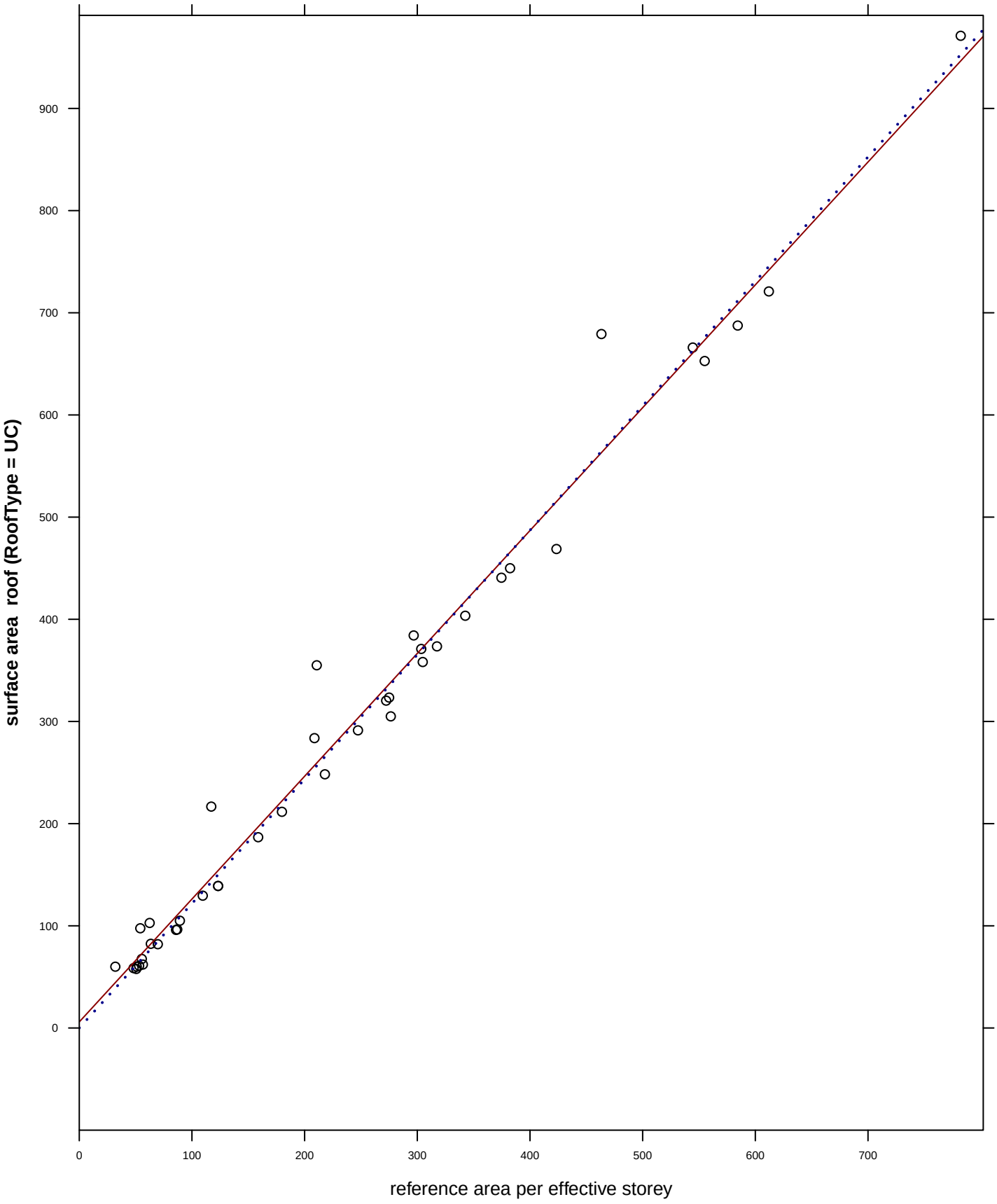

surface area roof (RoofType!=UC) ~ reference area per effective storey
by attic conditioned
not
partly
complete
flat roof
surface area roof (RoofType!=UC)
reference area per effective storey
0
300
600
900
1200
1500
1800
2100
2400
2700
3300
Dotted: With zero crossing

Intercept, slope and R^2, slope and R^2 at zerocrossing

surface area roof (RoofType != UC) ~ reference area per effective storey
by attic conditioned

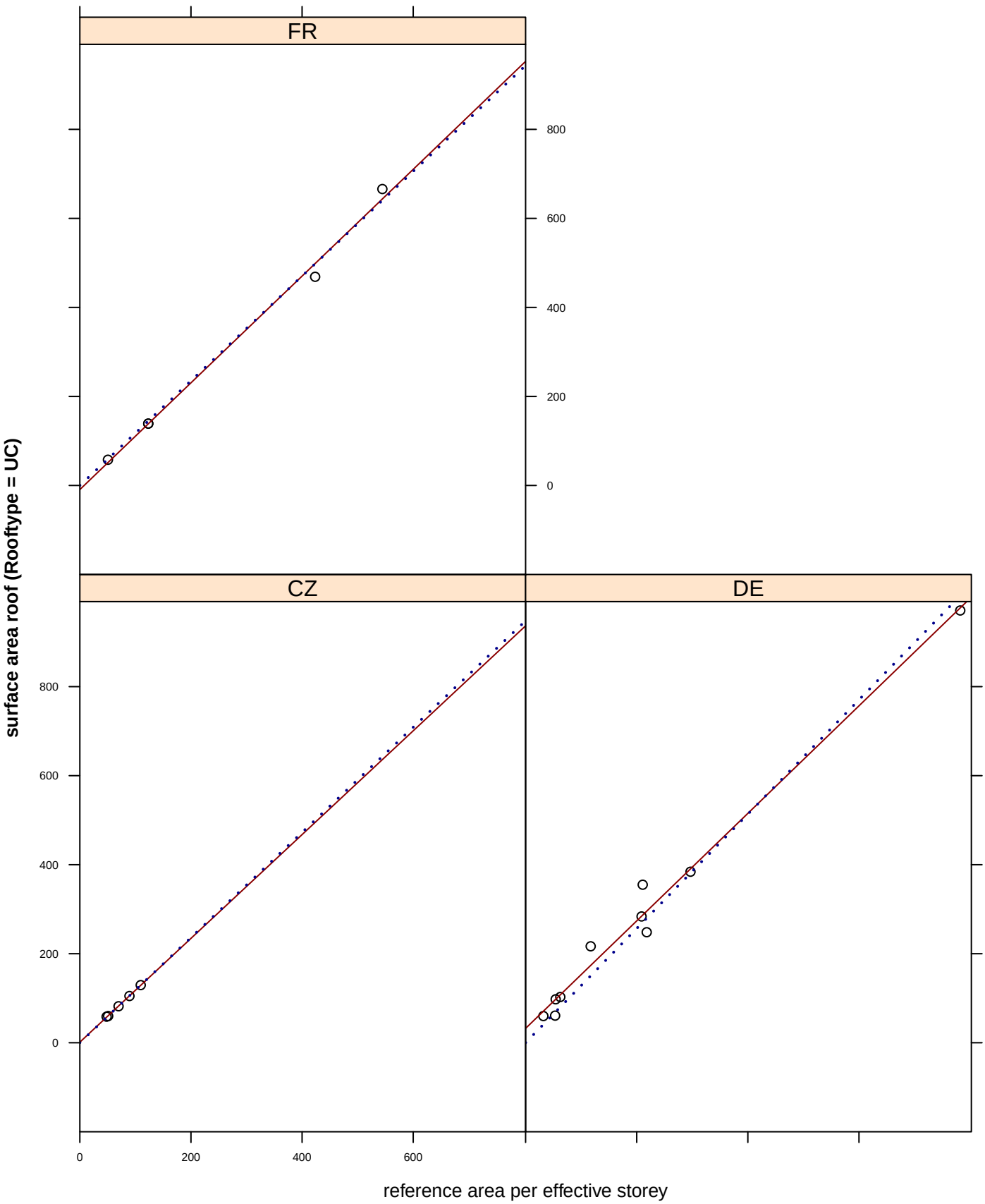
	b	m	R^2	0_m	0_R^2	n
A_Roof/RoofType!=UC: not conditioned	26.163	1.247	0.9	1.368	0.959	53
A_Roof/RoofType!=UC: partly conditioned	29.971	1.094	0.756	1.48	0.998	5
A_Roof/RoofType!=UC: completely condit.	20.288	1.415	0.964	1.529	0.98	46
A_Roof/RoofType!=UC: flat roof	−15.322	1.435	0.978	1.404	0.987	153

surface area roof (RoofType = UC) ~ reference area per effective storey (n= 41)
R^2 = 0.98 ,b = 5.94 , m = 1.20

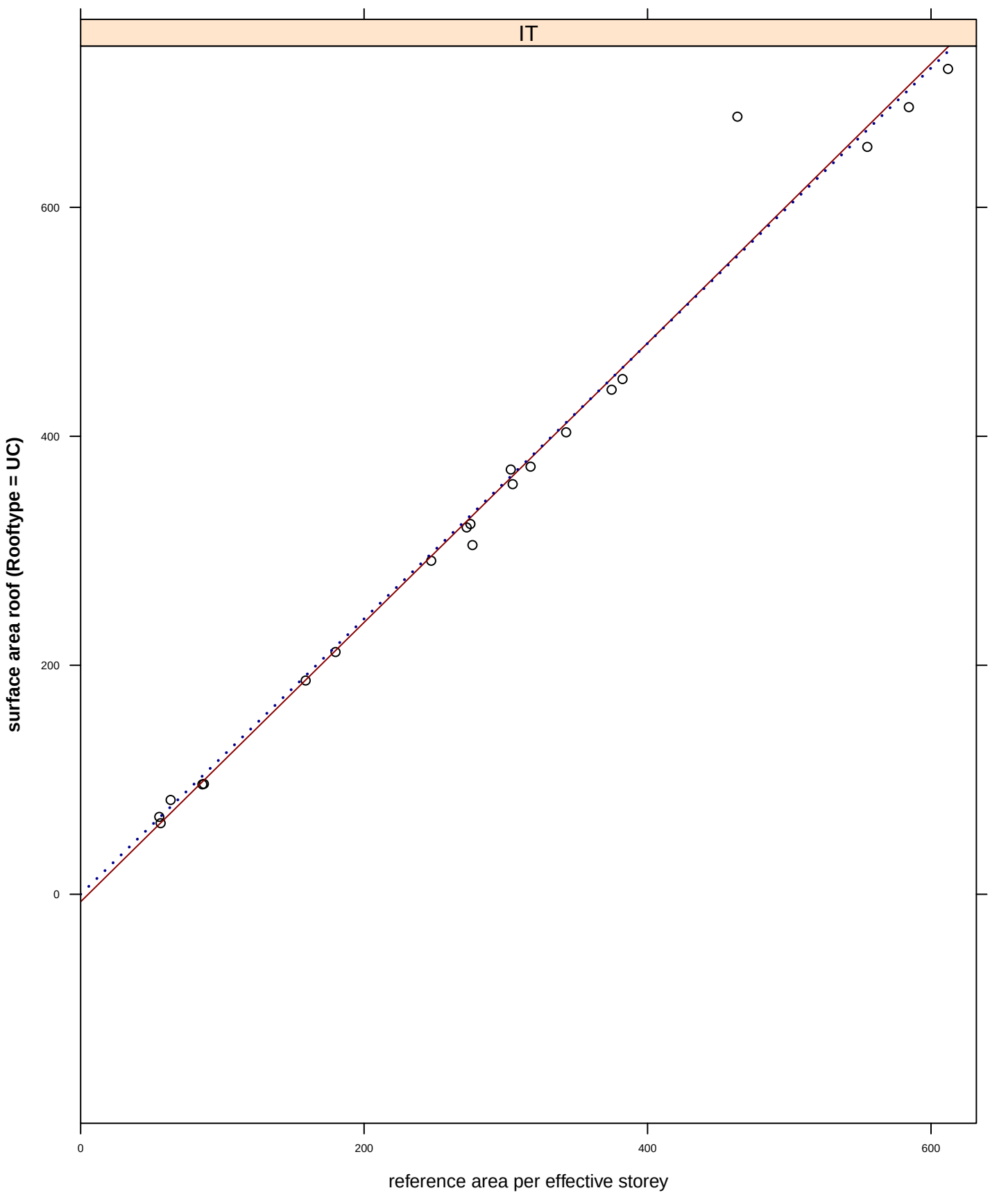


(Dotted = zero crossing: R^2 = 0.99 , m = 1.21)

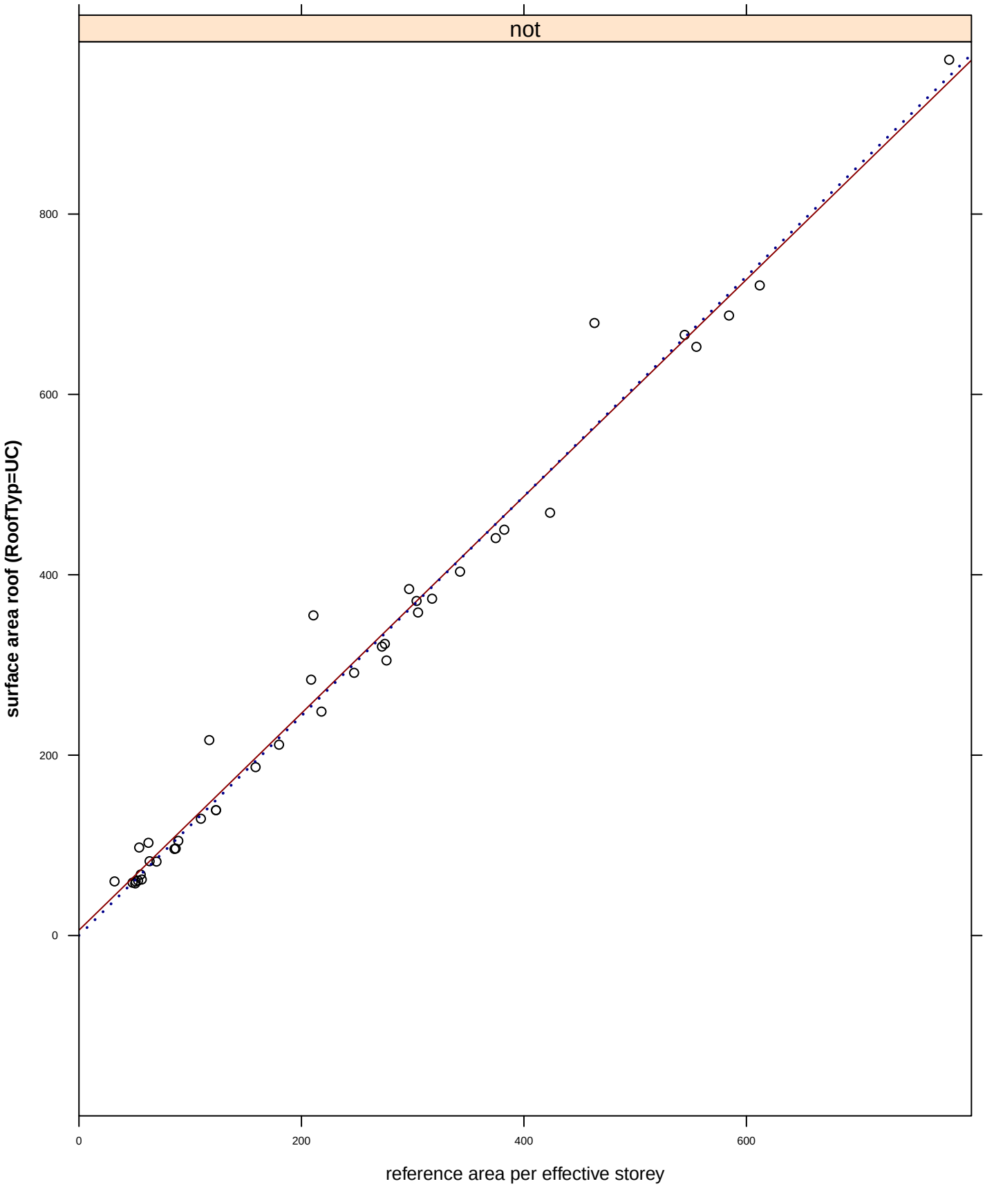
surface area roof (Rooftype = UC) ~ reference area per effective storey
by countries I



Dotted: With zero crossing


surface area roof (Rooftype = UC) ~ reference area per effective storey
by countries II
IT
surface area roof (Rooftype = UC)
0
200
400
600
0
200
400
600
reference area per effective storey
Dotted: With zero crossing

surface area roof (RoofTyp=UC) ~ reference area per effective storey
by attic conditioned



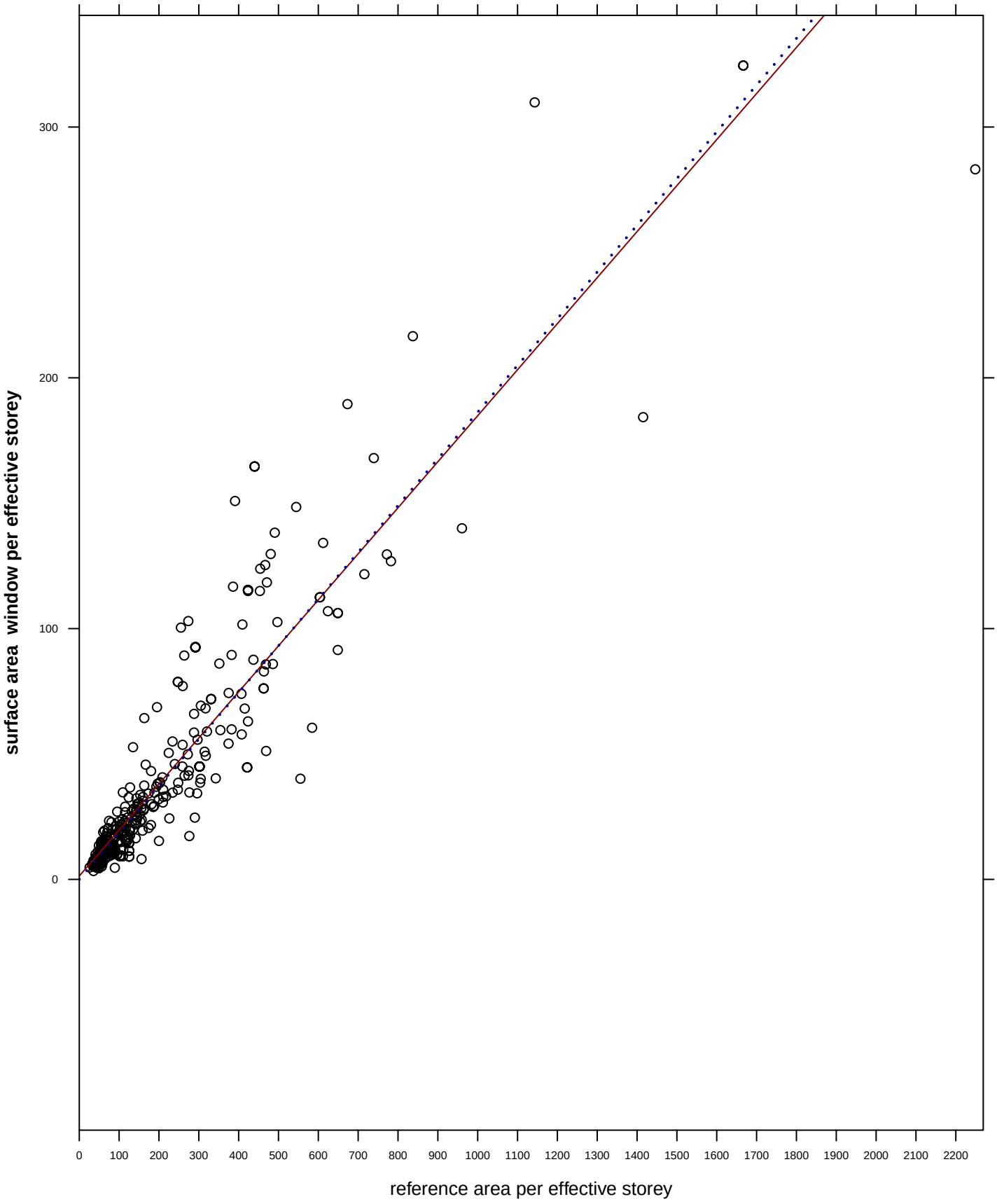
Dotted: With zero crossing

Intercept, slope and R^2, slope and R^2 at zerocrossing

surface area roof (RoofType = UC) ~ reference area per effective storey
by attic conditioned

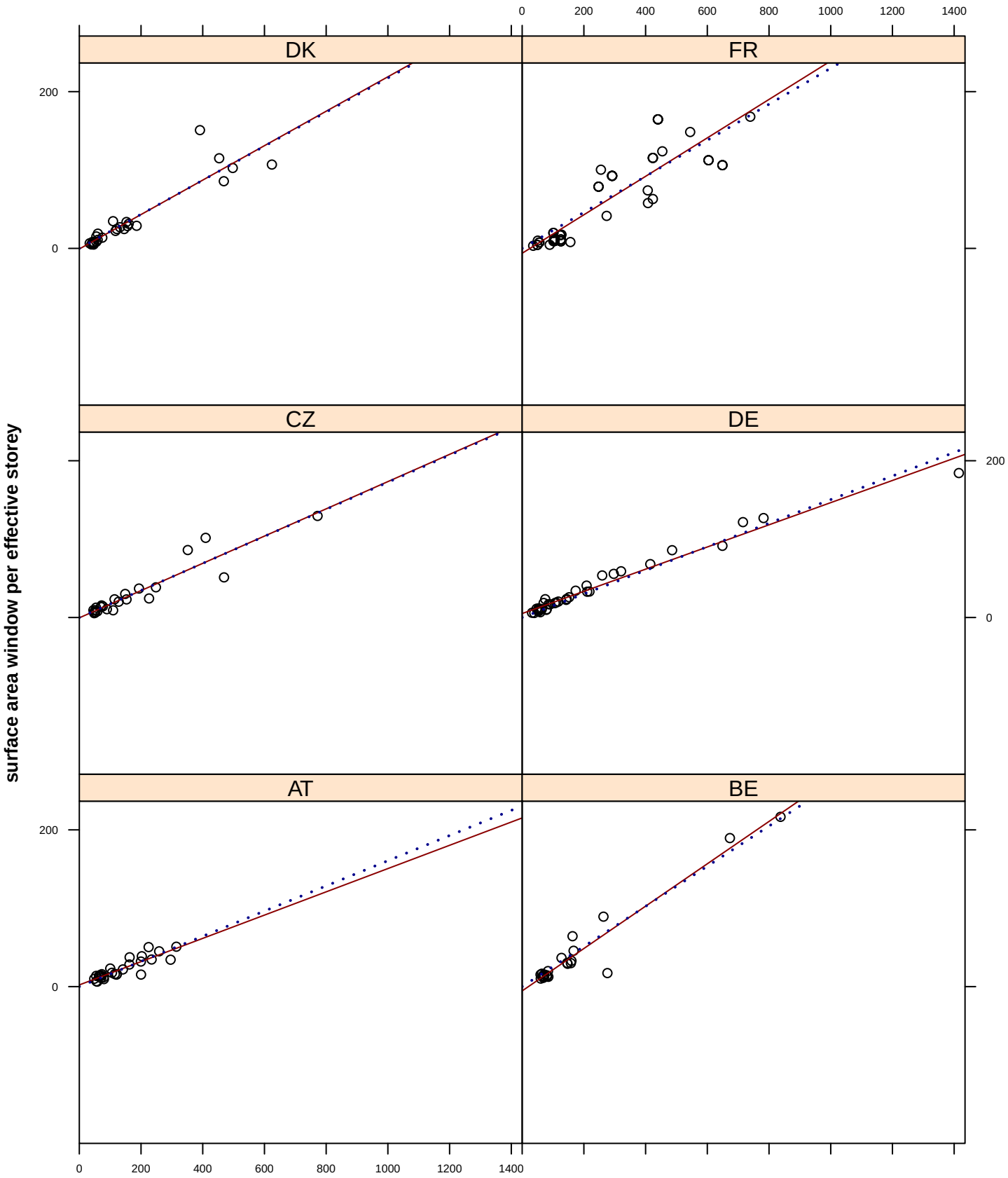
	b	m	R^2	0_m	0_R^2	n
A_Roof/RoofType=UC: not conditioned	5.949	1.202	0.981	1.218	0.993	41
A_Roof/RoofType=UC: partly conditioned						
A_Roof/RoofType=UC: completely condit.						
A_Roof/RoofType=UC: flat roof						

surface area window per effective storey ~ reference area per effective storey (n= 417)
R^2 = 0.84 ,b = 1.33 , m = 0.18



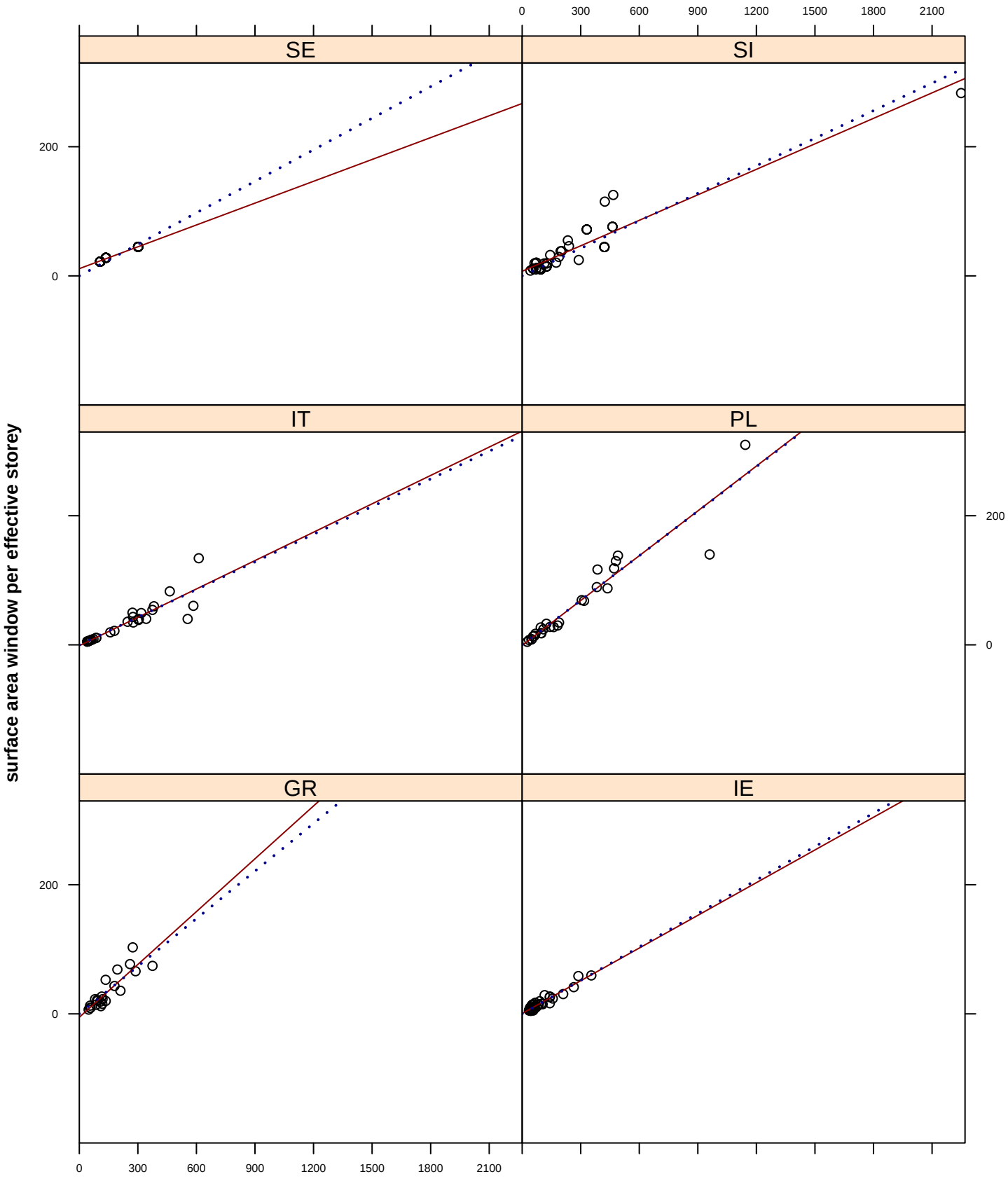
(Dotted = zero crossing: R^2 = 0.90 , m = 0.18)

surface area window per effective storey ~ reference area per effective storey
by countries I



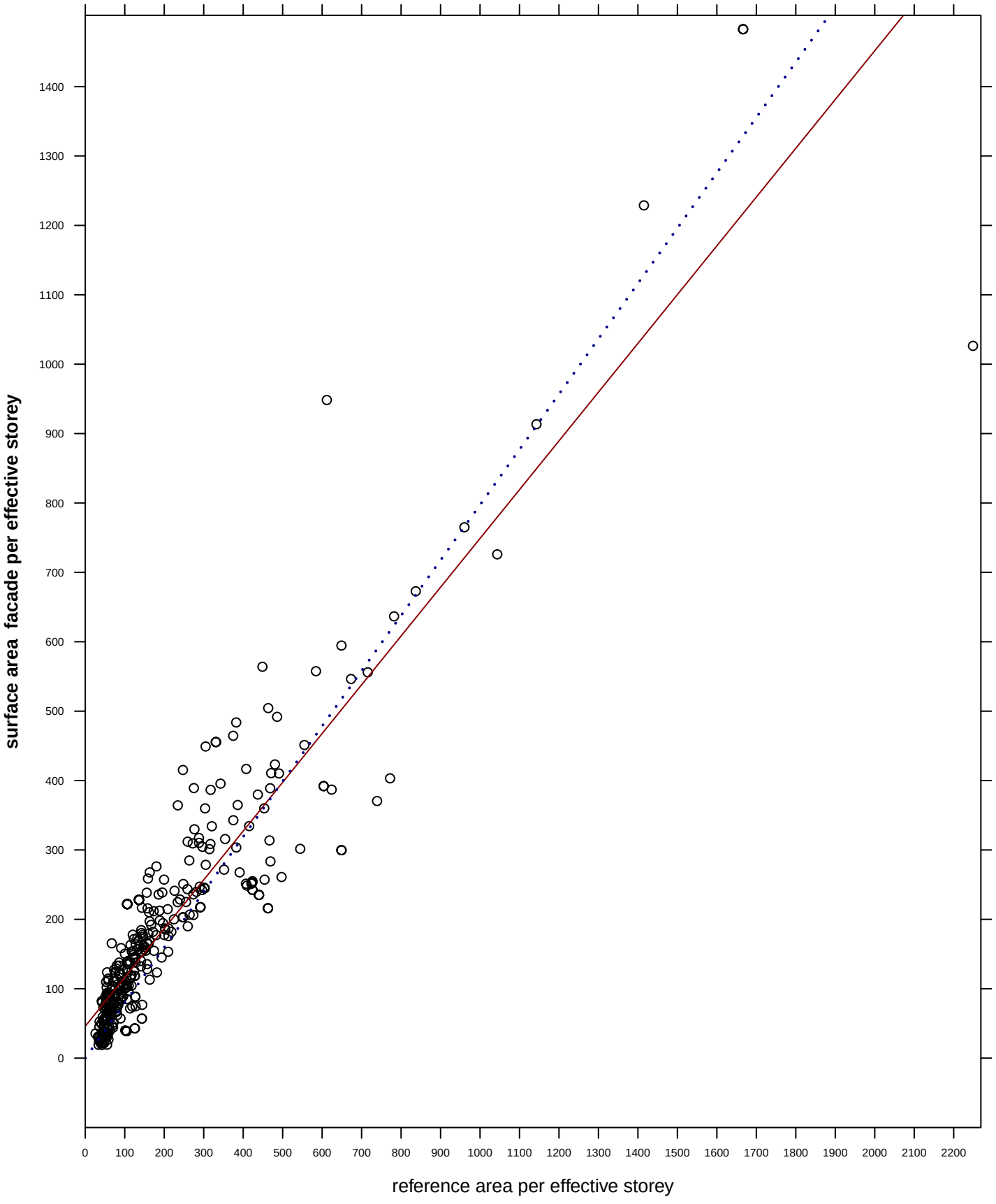
Dotted: With zero crossing

surface area window per effective storey ~ reference area per effective storey
by countries II



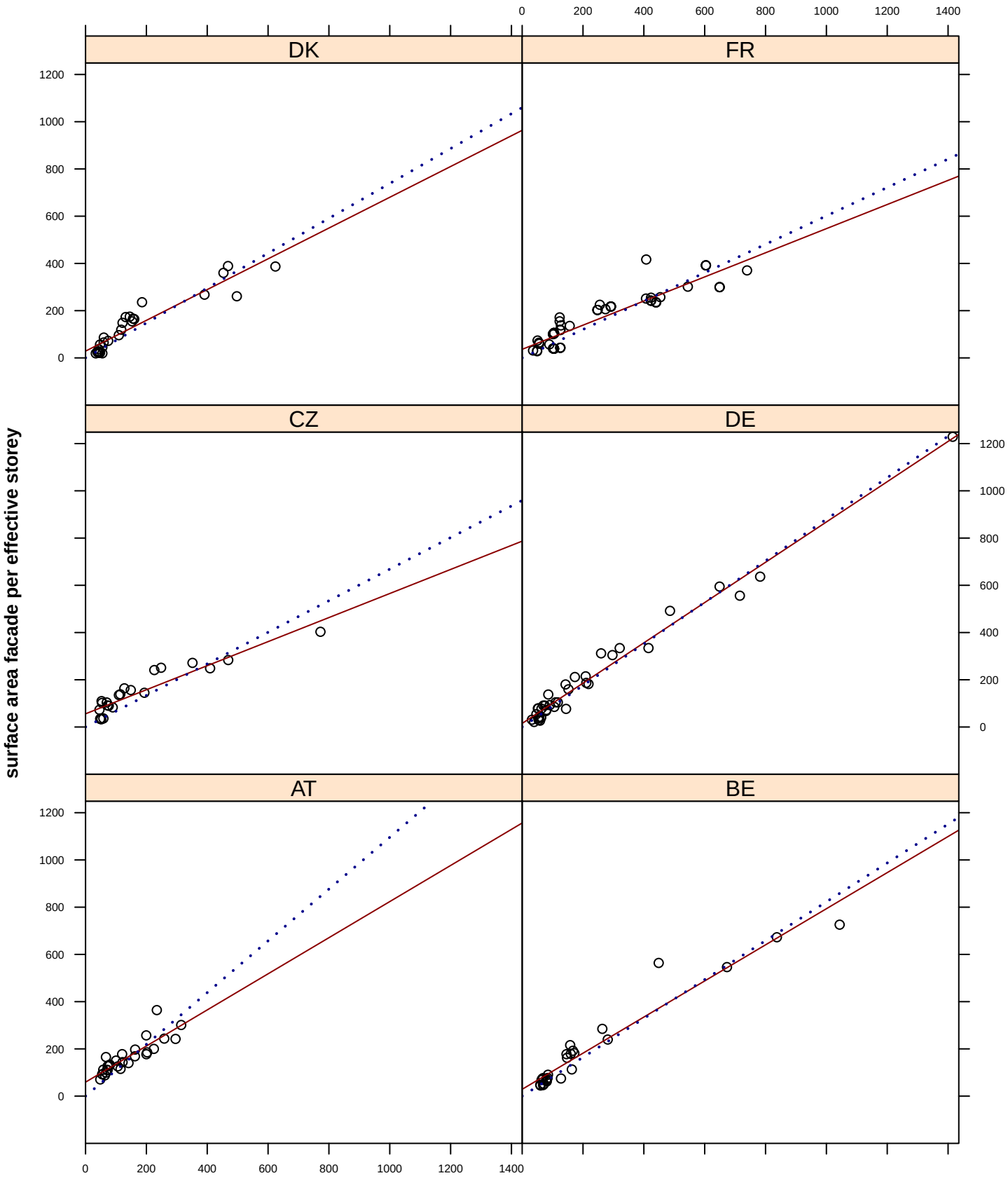
Dotted: With zero crossing

surface area facade per effective storey ~ reference area per effective storey (n= 425)
R^2 = 0.83 ,b = 46.0 , m = 0.70



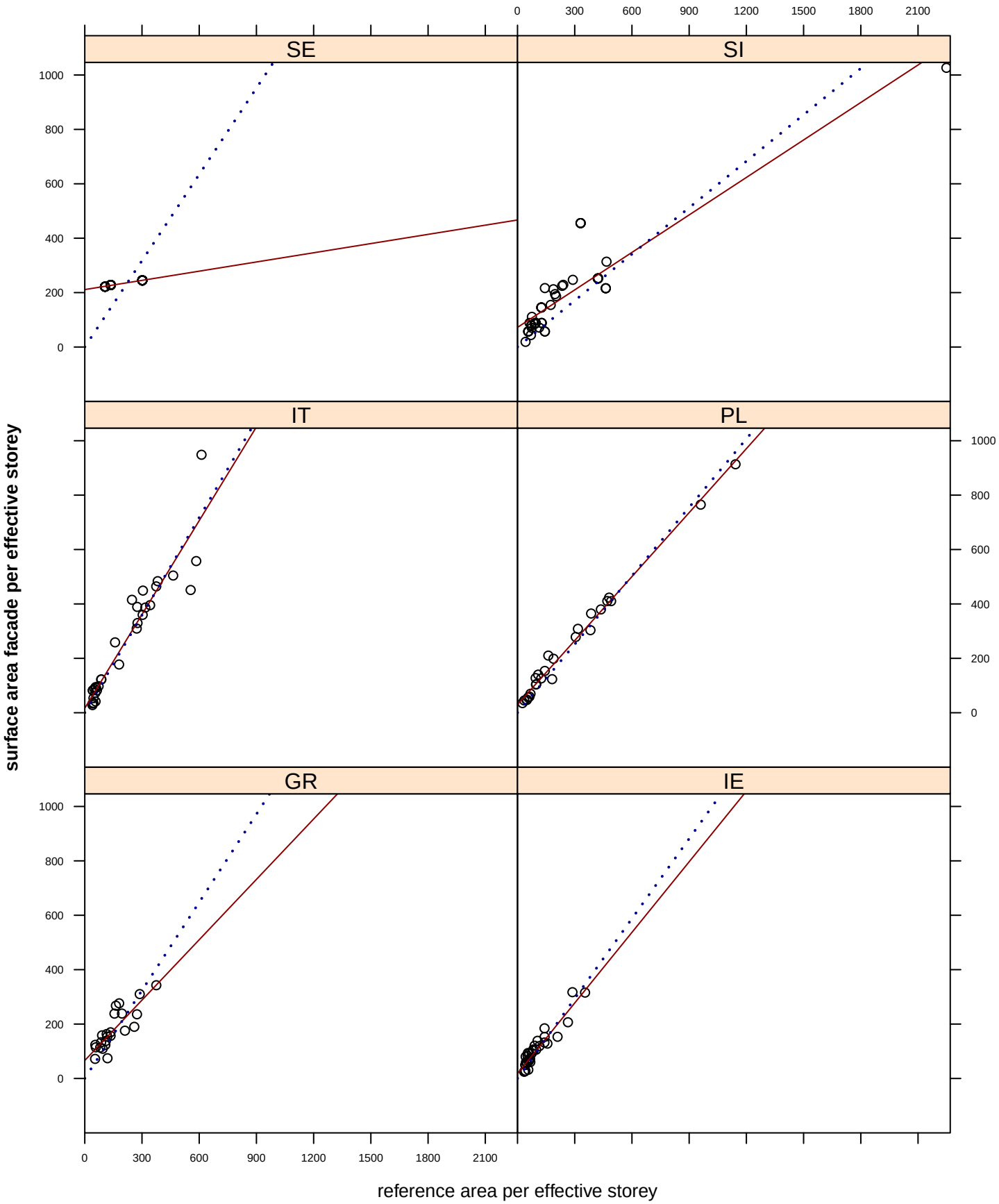
(Dotted = zero crossing: R^2 = 0.90 , m = 0.79)

surface area facade per effective storey ~ reference area per effective storey
by countries I



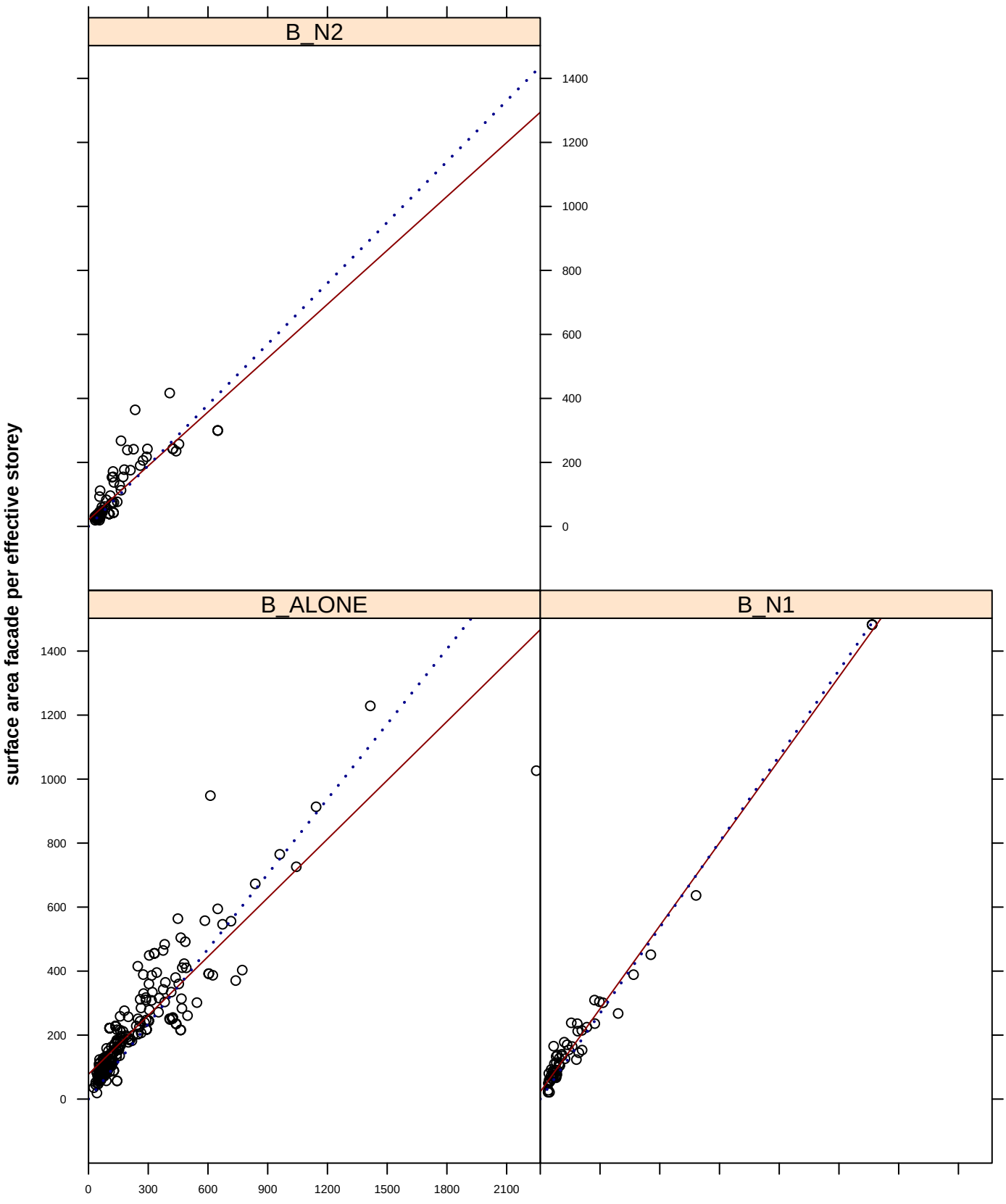
Dotted: With zero crossing

surface area facade per effective storey ~ reference area per effective storey
by countries II



Dotted: With zero crossing

surface area facade per effective storey ~ reference area per effective storey
by <AttachedNeighbours



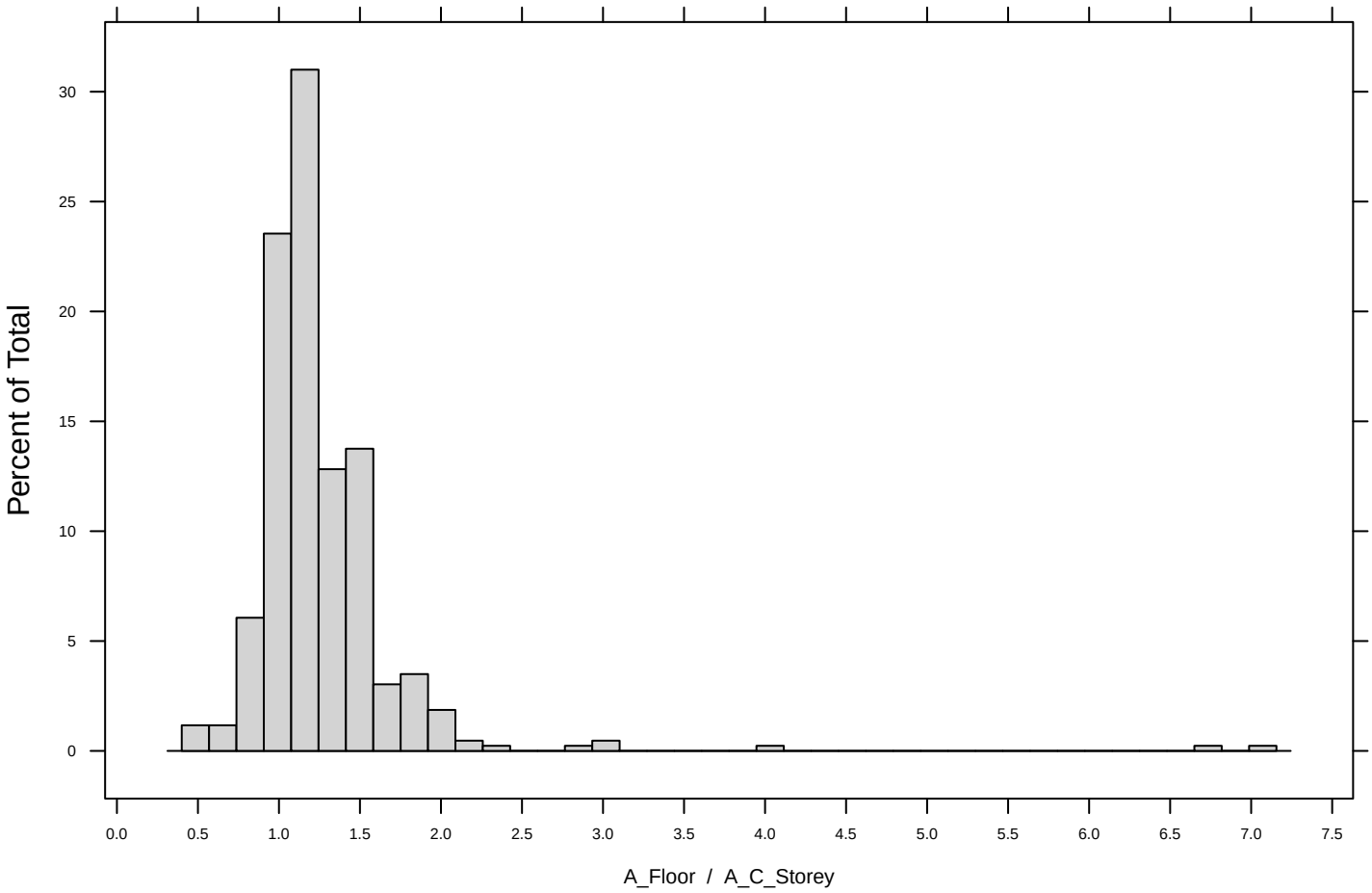
Dotted: With zero crossing

Intercept, slope and R^2, slope and R^2 at zerocrossing

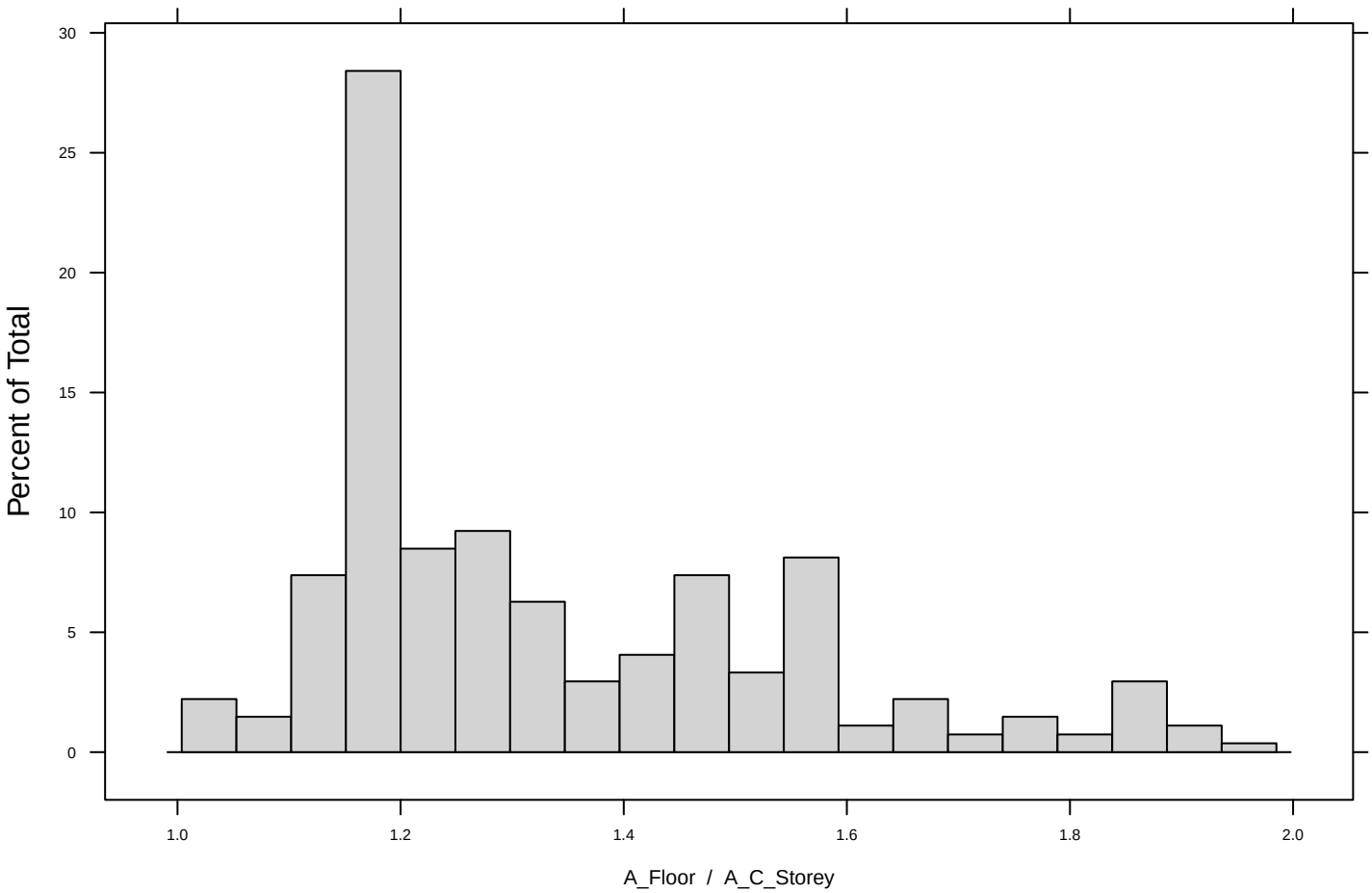
surface area facade per storey ~ reference area per effective storey
by <AttachedNeighbours>

	b	m	R^2	0_m	0_R^2	n
A_Fac_Storey: stand−alone building	77.756	0.612	0.769	0.781	0.875	277
A_Fac_Storey: 1 neighbour	22.958	0.864	0.989	0.893	0.99	64
A_Fac_Storey: 2 neighbours	20.725	0.561	0.727	0.633	0.859	84

Number of cases: 429 without data correction



Number of cases: 271 AFTER data correction



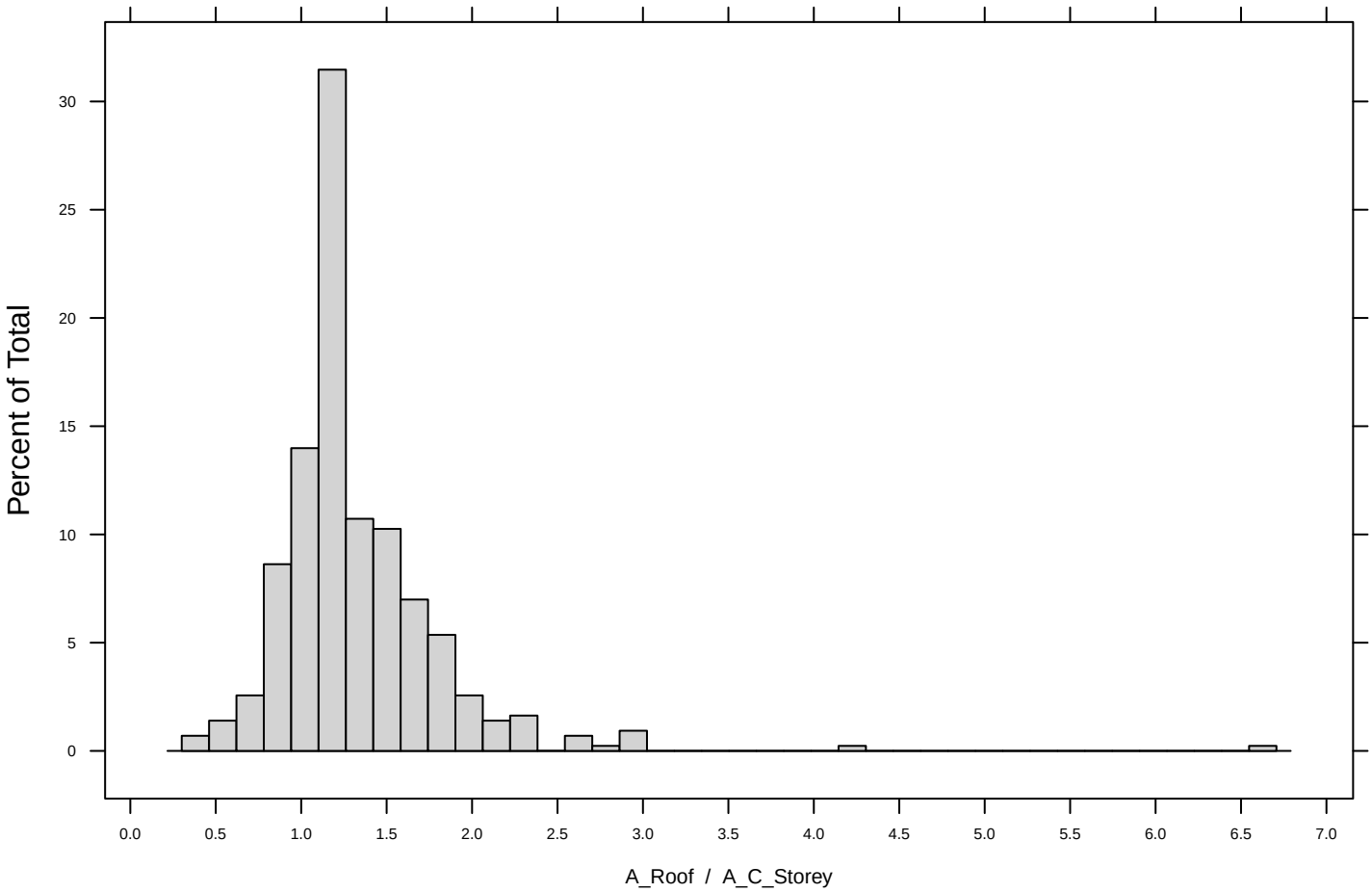
removed cases A_Floor

Code_Building	A_C_Storey	A_Floor	A_Floor/A_C_Storey	Corr
AT.N.SFH.04.Gen.ReEx.001	48.42105	143.8	2.9697826	P
AT.N.TH.02.Gen.ReEx.001	120.30000	103.8	0.8628429	P
AT.N.TH.04.Gen.ReEx.001	58.25000	52.5	0.9012876	P
AT.N.TH.07.Gen.ReEx.001	63.65000	60.4	0.9489395	P
AT.N.AB.02.Gen.ReEx.001	295.82500	229.2	0.7747824	P
BE.N.SFH.01.Gen.ReEx.001	157.81818	134.3	0.8509793	P
BE.N.TH.01.Gen.ReEx.001	80.84211	75.7	0.9363932	P
BE.N.SFH.02.Gen.ReEx.001	145.74545	126.7	0.8693239	P
BE.N.SFH.03.Gen.ReEx.001	147.41818	146.4	0.9930932	P
BE.N.MFH.03.small.ReEx.001	59.50000	243.0	4.0840336	P
BE.N.MFH.03.Gen.ReEx.001	276.26000	110.5	0.3999855	P
BE.N.SFH.04.Gen.ReEx.001	159.70909	138.8	0.8690801	P
BE.N.TH.04.Gen.ReEx.001	68.54737	63.2	0.9219902	P
BE.N.SFH.05.Gen.ReEx.001	166.69091	131.9	0.7912849	P
BE.N.TH.05.Gen.ReEx.001	71.53684	60.0	0.8387287	P
BE.N.MFH.05.Gen.ReEx.001	673.20000	632.1	0.9389483	P
BE.N.AB.05.Gen.ReEx.001	281.27273	2012.8	7.1560440	P
CZ.N.SFH.02.Gen.ReEx.001	45.77143	42.8	0.9350811	P
CZ.N.SFH.03.Gen.ReEx.001	76.28571	67.0	0.8782772	P
CZ.N.SFH.04.Gen.ReEx.001	72.25000	65.8	0.9107266	P
CZ.N.TH.01.Gen.ReEx.001	89.30000	85.1	0.9529675	P
DE.N.SFH.05.Gen.ReEx.001	152.11429	145.0	0.9532307	P
DE.N.SFH.06.Gen.ReEx.001	173.30000	152.3	0.8788229	P
DE.N.SFH.08.Gen.ReEx.001	85.82857	75.3	0.8773302	P
DE.N.TH.03.Gen.ReEx.001	56.40000	50.4	0.8936170	P
DE.N.TH.04.Gen.ReEx.001	74.80000	81.2	1.0855615	P
DE.N.TH.05.Gen.ReEx.001	58.70000	46.2	0.7870528	P
DE.N.TH.09.Gen.ReEx.001	54.10909	51.9	0.9591734	P
DE.N.MFH.08.Gen.ReEx.001	259.36667	249.4	0.9615731	P
DE.N.MFH.10.Gen.ReEx.001	648.91852	619.5	0.9546653	P
DE.N.AB.05.Gen.ReEx.001	485.92500	459.2	0.9450018	P
DE.N.AB.05.HR.ReEx.001	715.55000	754.9	1.0549927	P
DE.N.AB.06.HR.ReEx.001	1415.22857	1469.0	1.0379949	P
DK.N.SFH.01.Gen.ReEx.001	131.80000	127.0	0.9635812	P
DK.N.SFH.05.Gen.ReEx.001	153.00000	160.0	1.0457516	P
DK.N.SFH.06.Gen.ReEx.001	117.30000	118.0	1.0059676	P
DK.N.SFH.07.Gen.ReEx.001	121.60000	122.0	1.0032895	P
DK.N.SFH.09.Gen.ReEx.001	145.40000	149.0	1.0247593	P
DK.N.TH.07.Gen.ReEx.001	42.50000	43.0	1.0117647	P
DK.N.TH.08.Gen.ReEx.001	33.73333	34.0	1.0079051	P
DK.N.TH.09.Gen.ReEx.001	55.25000	118.0	2.1357466	P
DK.N.AB.01.Gen.ReEx.001	185.75000	201.1	1.0826380	P
DK.N.AB.04.Gen.ReEx.001	156.00000	147.0	0.9423077	P
FR.N.SFH.01.Gen.ReEx.001	156.20000	142.0	0.9090909	P
FR.N.SFH.02.Gen.ReEx.001	89.25714	63.9	0.7159091	P
FR.N.SFH.03.Gen.ReEx.001	56.00000	56.0	1.0000000	P
FR.N.SFH.04.Gen.ReEx.001	55.00000	50.0	0.9090909	P
FR.N.SFH.05.Gen.ReEx.001	101.20000	92.0	0.9090909	P
FR.N.SFH.06.Gen.ReEx.001	50.60000	51.5	1.0177866	P
FR.N.SFH.07.Gen.ReEx.001	101.20000	92.0	0.9090909	P
FR.H1.SFH.08.Gen.ReEx.001	125.40000	114.0	0.9090909	P
FR.H2.SFH.08.Gen.ReEx.001	125.40000	114.0	0.9090909	P
FR.H3.SFH.08.Gen.ReEx.001	125.40000	114.0	0.9090909	P
FR.H1.SFH.09.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.H2.SFH.09.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.H3.SFH.09.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.H1.SFH.10.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.H2.SFH.10.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.H3.SFH.10.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.N.TH.02.Gen.ReEx.001	35.74545	30.6	0.8560529	P
FR.N.TH.03.Gen.ReEx.001	49.15000	44.8	0.9114954	P
FR.N.TH.04.Gen.ReEx.001	49.15000	44.8	0.9114954	P
FR.N.TH.07.Gen.ReEx.001	101.20000	92.0	0.9090909	P
FR.H1.TH.08.Gen.ReEx.001	125.40000	114.0	0.9090909	P
FR.H2.TH.08.Gen.ReEx.001	125.40000	114.0	0.9090909	P
FR.H3.TH.08.Gen.ReEx.001	125.40000	114.0	0.9090909	P
FR.H1.TH.09.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.H2.TH.09.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.H3.TH.09.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.H1.TH.10.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.H2.TH.10.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.H3.TH.10.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.N.MFH.01.Gen.ReEx.001	123.20000	120.4	0.9772727	P
FR.N.MFH.02.Gen.ReEx.001	127.40870	120.4	0.9449904	P
FR.N.MFH.03.Gen.ReEx.001	273.77778	250.0	0.9131494	P
FR.N.MFH.04.Gen.ReEx.001	423.50000	406.0	0.9586777	P
FR.N.MFH.05.Gen.ReEx.001	255.20000	266.0	1.0423197	P
FR.N.MFH.06.Gen.ReEx.001	291.50000	283.5	0.9725557	P
FR.N.MFH.07.Gen.ReEx.001	291.50000	283.5	0.9725557	P
FR.H1.MFH.08.Gen.ReEx.001	291.50000	283.5	0.9725557	P
FR.H2.MFH.08.Gen.ReEx.001	291.50000	283.5	0.9725557	P
FR.H3.MFH.08.Gen.ReEx.001	291.50000	283.5	0.9725557	P
FR.H1.MFH.09.Gen.ReEx.001	247.50000	250.0	1.0101010	P
FR.H2.MFH.09.Gen.ReEx.001	247.50000	250.0	1.0101010	P
FR.H3.MFH.09.Gen.ReEx.001	247.50000	250.0	1.0101010	P
FR.H1.MFH.10.Gen.ReEx.001	423.50000	428.4	1.0115702	P
FR.H2.MFH.10.Gen.ReEx.001	423.50000	428.4	1.0115702	P
FR.H3.MFH.10.Gen.ReEx.001	423.50000	428.4	1.0115702	P
FR.N.AB.01.Gen.ReEx.001	123.20000	120.4	0.9772727	P
FR.N.AB.02.Gen.ReEx.001	407.73333	402.5	0.9871648	P

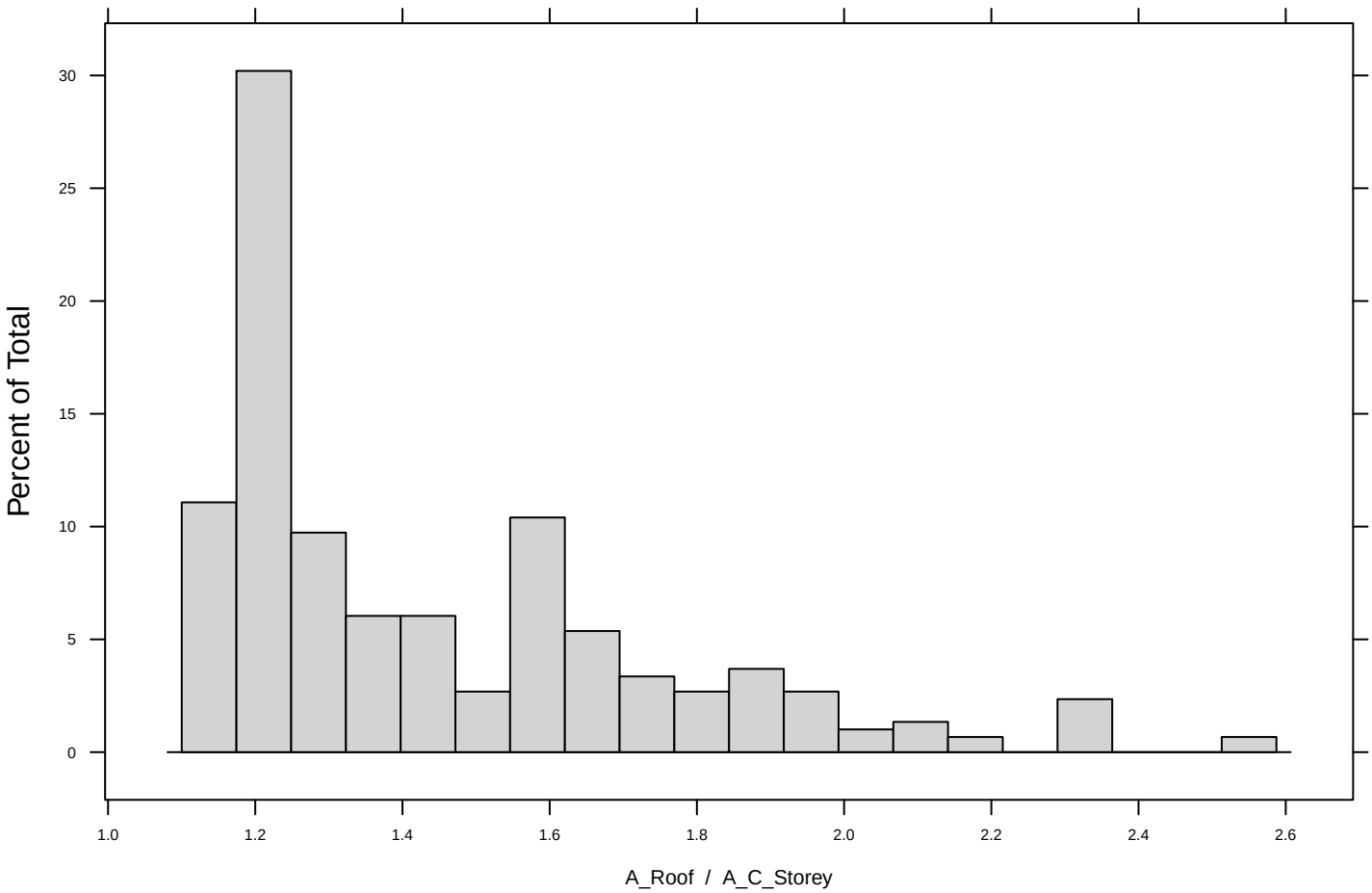
removed cases A_Floor (continuation)

Code_Building	A_C_Storey	A_Floor	A_Floor/A_C_Storey	Corr
FR.N.AB.03.Gen.ReEx.001	454.19355	435.0	0.9577415	P
FR.N.AB.04.Gen.ReEx.001	544.50000	555.0	1.0192837	P
FR.N.AB.05.Gen.ReEx.001	739.20000	750.0	1.0146104	P
FR.N.AB.06.Gen.ReEx.001	407.00000	414.8	1.0191646	P
FR.N.AB.07.Gen.ReEx.001	440.00000	441.0	1.0022727	P
FR.H1.AB.08.Gen.ReEx.001	440.00000	441.0	1.0022727	P
FR.H2.AB.08.Gen.ReEx.001	440.00000	441.0	1.0022727	P
FR.H3.AB.08.Gen.ReEx.001	440.00000	441.0	1.0022727	P
FR.H1.AB.09.Gen.ReEx.001	603.90000	615.0	1.0183805	P
FR.H2.AB.09.Gen.ReEx.001	603.90000	615.0	1.0183805	P
FR.H3.AB.09.Gen.ReEx.001	603.90000	615.0	1.0183805	P
FR.H1.AB.10.Gen.ReEx.001	649.00000	654.5	1.0084746	P
FR.H2.AB.10.Gen.ReEx.001	649.00000	654.5	1.0084746	P
FR.H3.AB.10.Gen.ReEx.001	649.00000	654.5	1.0084746	P
GR.ZoneB.MFH.01.Gen.ReEx.001	259.63636	227.0	0.8742997	P
GR.ZoneA.SFH.01.Gen.ReEx.001	110.50000	108.0	0.9773756	P
GR.ZoneD.SFH.01.Gen.ReEx.001	155.60000	100.0	0.6426735	P
GR.ZoneD.SFH.03.Gen.ReEx.001	55.25000	47.0	0.8506787	P
GR.ZoneD.SFH.02.Gen.ReEx.001	180.20000	126.0	0.6992231	P
GR.ZoneC.SFH.02.Gen.ReEx.001	54.10909	120.0	2.2177419	P
IE.N.SFH.01.Gen.ReEx.001	115.10000	125.0	1.0860122	P
IE.N.SFH.01.325SB.ReEx.001	89.75000	89.8	1.0005571	P
IE.N.SFH.01.MassConc.ReEx.001	105.00000	115.5	1.1000000	P
IE.N.TH.01.MassConc.ReEx.001	40.50000	43.8	1.0814815	P
IE.N.SFH.01.HBlock.ReEx.001	141.10000	154.4	1.0942594	P
IE.N.TH.02.Gen.ReEx.001	41.60000	45.7	1.0985577	P
IE.N.SFH.02.HBlock.ReEx.001	141.70000	87.7	0.6189132	P
IE.N.TH.05.Gen.ReEx.001	56.55000	61.7	1.0910698	P
IE.N.AB.03.Gen.ReEx.001	156.64000	164.8	1.0520940	P
PL.N.AB.03.Gen.ReEx.001	385.98182	416.0	1.0777710	P
PL.N.MFH.01.Gen.ReEx.001	161.50000	334.0	2.0681115	P
PL.N.TH.01.Gen.ReEx.001	124.10000	292.0	2.3529412	P
PL.N.TH.04.Gen.ReEx.001	95.20000	101.0	1.0609244	P
PL.N.TH.05.Gen.ReEx.001	143.15000	154.0	1.0757946	P
RS.N.SFH.03.Gen.ReEx.001	36.25000	74.0	2.0413793	P
XX.N.MFH.01.Gen.ReEx.001	1666.50000	754.9	0.4529853	P
XX.N.MFH.02.Gen.ReEx.001	1666.50000	754.9	0.4529853	P
XX.N.MFH.03.Gen.ReEx.001	1666.50000	754.9	0.4529853	P
SI.N.SFH.02.Un_refur.ReEx.001	126.66667	98.6	0.7784211	P
SI.N.SFH.02.Med_refur.ReEx.001	126.66667	98.6	0.7784211	P
SI.N.SFH.02.Full_refur.ReEx.001	126.66667	98.6	0.7784211	P
SI.N.SFH.03.Un_refur.ReEx.001	90.50000	89.2	0.9856354	P
SI.N.SFH.03.Med_refur.ReEx.001	90.50000	89.2	0.9856354	P
SI.N.SFH.03.Full_refur.ReEx.001	90.50000	89.2	0.9856354	P
SI.N.SFH.04.Un_refur.ReEx.001	56.60000	113.2	2.0000000	P
SI.N.SFH.04.Med_refur.ReEx.001	56.60000	113.2	2.0000000	P
SI.N.SFH.04.Full_refur.ReEx.001	56.60000	113.2	2.0000000	P
SI.N.SFH.05.Standard.ReEx.001	95.00000	104.2	1.0968421	P
SI.N.SFH.05.High_stand.ReEx.001	95.00000	104.2	1.0968421	P
SI.N.SFH.05.Low_E.ReEx.001	95.00000	104.2	1.0968421	P
SI.N.SFH.06.High_stand.ReEx.001	143.40000	129.6	0.9037657	P
SI.N.SFH.06.Low_E.ReEx.001	143.40000	129.6	0.9037657	P
SI.N.MFH.06.High_stand.ReEx.001	462.75000	395.1	0.8538088	P
SI.N.MFH.06.Low_E.ReEx.001	462.75000	395.1	0.8538088	P
SI.N.AB.01.Gen.ReEx.001	202.07692	220.0	1.0886943	P
SI.N.AB.06.Gen.ReEx.001	466.61538	1341.0	2.8738872	P
SI.N.MFH.01.Gen.ReEx.001	290.00000	297.0	1.0241379	P
SI.N.MFH.02.Gen.ReEx.001	42.19231	283.0	6.7073838	P
SI.N.MFH.06.Gen.ReEx.001	462.75000	395.1	0.8538088	P
SI.N.SFH.01.Gen.ReEx.001	75.50000	226.0	2.9933775	P
SI.N.SFH.03.Gen.ReEx.001	90.50000	89.2	0.9856354	P
SI.N.SFH.04.Gen.ReEx.001	56.60000	113.2	2.0000000	P
SI.N.SFH.05.Gen.ReEx.001	95.00000	104.2	1.0968421	P
SI.N.SFH.06.Gen.ReEx.001	143.50000	129.6	0.9031359	P
SI.N.TH.02.Gen.ReEx.001	74.65000	64.0	0.8573342	P
SI.N.TH.04.Gen.ReEx.001	234.00000	145.8	0.6230769	P
SI.N.TH.05.Gen.ReEx.001	174.00000	161.2	0.9264368	P
SI.N.TH.06.Gen.ReEx.001	188.00000	100.2	0.5329787	P

Number of cases: 429 without data correction



Number of cases: 298 AFTER data correction



removed cases A_Roof

Code_Building	A_C_Storey	A_Roof	A_Roof/A_C_Storey	Corr
SI.N.SFH.01.Gen.ReEx.001	75.50000	226.0	2.9933775	Out
AT.N.SFH.04.Gen.ReEx.001	48.42105	143.8	2.9697826	Out
AT.N.SFH.02.Gen.ReEx.001	70.80000	207.3	2.9279661	Out
SI.N.AB.06.Gen.ReEx.001	466.61538	1341.0	2.8738872	Out
GR.ZoneD.SFH.03.Gen.ReEx.001	55.25000	150.0	2.7149321	Out
AT.N.TH.04.Gen.ReEx.001	58.25000	156.9	2.6935622	Out
AT.N.TH.02.Gen.ReEx.001	120.30000	118.5	0.9850374	P
AT.N.TH.07.Gen.ReEx.001	63.65000	65.8	1.0337785	P
AT.N.MFH.02.Gen.ReEx.001	78.80000	64.0	0.8121827	P
AT.N.AB.02.Gen.ReEx.001	295.82500	233.4	0.7889800	P
BE.N.SFH.01.Gen.ReEx.001	157.81818	157.4	0.9973502	P
BE.N.TH.01.Gen.ReEx.001	80.84211	81.1	1.0031901	P
BE.N.SFH.02.Gen.ReEx.001	145.74545	157.5	1.0806512	P
BE.N.TH.02.Gen.ReEx.001	71.15789	81.5	1.1453402	P
BE.N.SFH.03.Gen.ReEx.001	147.41818	169.2	1.1477553	P
BE.N.TH.03.Gen.ReEx.001	60.25263	71.2	1.1816911	P
BE.N.MFH.03.small.ReEx.001	59.50000	255.2	4.2890756	P
BE.N.MFH.03.Gen.ReEx.001	276.26000	128.0	0.4633316	P
BE.N.SFH.04.Gen.ReEx.001	159.70909	160.4	1.0043260	P
BE.N.TH.04.Gen.ReEx.001	68.54737	75.1	1.0955928	P
BE.N.SFH.05.Gen.ReEx.001	166.69091	152.3	0.9136671	P
BE.N.TH.05.Gen.ReEx.001	71.53684	68.2	0.9533549	P
BE.N.MFH.05.Gen.ReEx.001	673.20000	626.0	0.9298871	P
CZ.N.SFH.03.Gen.ReEx.001	76.28571	72.2	0.9464419	P
DE.N.SFH.05.Gen.ReEx.001	152.11429	180.9	1.1892374	P
DE.N.SFH.06.Gen.ReEx.001	173.30000	183.1	1.0565493	P
DE.N.TH.03.Gen.ReEx.001	56.40000	50.4	0.8936170	P
DE.N.TH.04.Gen.ReEx.001	74.80000	81.2	1.0855615	P
DE.N.TH.05.Gen.ReEx.001	58.70000	46.2	0.7870528	P
DE.N.MFH.08.Gen.ReEx.001	259.36667	249.4	0.9615731	P
DE.N.MFH.10.Gen.ReEx.001	648.91852	580.0	0.8937948	P
DE.N.AB.05.Gen.ReEx.001	485.92500	479.6	0.9869836	P
DE.N.AB.05.HR.ReEx.001	715.55000	501.2	0.7004402	P
DE.N.AB.06.HR.ReEx.001	1415.22857	1469.0	1.0379949	P
DK.N.AB.04.Gen.ReEx.001	156.00000	163.0	1.0448718	P
FR.N.SFH.01.Gen.ReEx.001	156.20000	142.0	0.9090909	P
FR.N.SFH.02.Gen.ReEx.001	89.25714	95.0	1.0643406	P
FR.N.SFH.04.Gen.ReEx.001	55.00000	50.0	0.9090909	P
FR.N.SFH.05.Gen.ReEx.001	101.20000	92.0	0.9090909	P
FR.N.SFH.07.Gen.ReEx.001	101.20000	92.0	0.9090909	P
FR.H1.SFH.08.Gen.ReEx.001	125.40000	114.0	0.9090909	P
FR.H2.SFH.08.Gen.ReEx.001	125.40000	114.0	0.9090909	P
FR.H3.SFH.08.Gen.ReEx.001	125.40000	114.0	0.9090909	P
FR.H1.SFH.09.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.H2.SFH.09.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.H3.SFH.09.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.H1.SFH.10.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.H2.SFH.10.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.H3.SFH.10.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.N.TH.02.Gen.ReEx.001	35.74545	40.9	1.1442014	P
FR.N.TH.03.Gen.ReEx.001	49.15000	44.7	0.9094608	P
FR.N.TH.04.Gen.ReEx.001	49.15000	44.7	0.9094608	P
FR.N.TH.07.Gen.ReEx.001	101.20000	92.0	0.9090909	P
FR.H1.TH.08.Gen.ReEx.001	125.40000	114.0	0.9090909	P
FR.H2.TH.08.Gen.ReEx.001	125.40000	114.0	0.9090909	P
FR.H3.TH.08.Gen.ReEx.001	125.40000	114.0	0.9090909	P
FR.H1.TH.09.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.H2.TH.09.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.H3.TH.09.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.H1.TH.10.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.H2.TH.10.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.H3.TH.10.Gen.ReEx.001	104.50000	95.0	0.9090909	P
FR.N.MFH.05.Gen.ReEx.001	255.20000	266.0	1.0423197	P
FR.N.MFH.06.Gen.ReEx.001	291.50000	283.5	0.9725557	P
FR.N.MFH.07.Gen.ReEx.001	291.50000	283.5	0.9725557	P
FR.H1.MFH.08.Gen.ReEx.001	291.50000	283.5	0.9725557	P
FR.H2.MFH.08.Gen.ReEx.001	291.50000	283.5	0.9725557	P
FR.H3.MFH.08.Gen.ReEx.001	291.50000	283.5	0.9725557	P
FR.H1.MFH.09.Gen.ReEx.001	247.50000	250.0	1.0101010	P
FR.H2.MFH.09.Gen.ReEx.001	247.50000	250.0	1.0101010	P
FR.H3.MFH.09.Gen.ReEx.001	247.50000	250.0	1.0101010	P
FR.H1.MFH.10.Gen.ReEx.001	423.50000	428.4	1.0115702	P
FR.H2.MFH.10.Gen.ReEx.001	423.50000	428.4	1.0115702	P
FR.H3.MFH.10.Gen.ReEx.001	423.50000	428.4	1.0115702	P
FR.N.AB.05.Gen.ReEx.001	739.20000	750.0	1.0146104	P
FR.N.AB.06.Gen.ReEx.001	407.00000	414.8	1.0191646	P
FR.N.AB.07.Gen.ReEx.001	440.00000	441.0	1.0022727	P
FR.H1.AB.08.Gen.ReEx.001	440.00000	441.0	1.0022727	P
FR.H2.AB.08.Gen.ReEx.001	440.00000	441.0	1.0022727	P
FR.H3.AB.08.Gen.ReEx.001	440.00000	441.0	1.0022727	P
FR.H1.AB.09.Gen.ReEx.001	603.90000	615.0	1.0183805	P
FR.H2.AB.09.Gen.ReEx.001	603.90000	615.0	1.0183805	P
FR.H3.AB.09.Gen.ReEx.001	603.90000	615.0	1.0183805	P
FR.H1.AB.10.Gen.ReEx.001	649.00000	654.5	1.0084746	P
FR.H2.AB.10.Gen.ReEx.001	649.00000	654.5	1.0084746	P
FR.H3.AB.10.Gen.ReEx.001	649.00000	654.5	1.0084746	P
GR.ZoneD.SFH.01.Gen.ReEx.001	155.60000	100.0	0.6426735	P
GR.ZoneD.SFH.02.Gen.ReEx.001	180.20000	126.0	0.6992231	P
IE.N.SFH.01.Gen.ReEx.001	115.10000	125.0	1.0860122	P
IE.N.TH.01.225SB.ReEx.001	66.00000	71.7	1.0863636	P

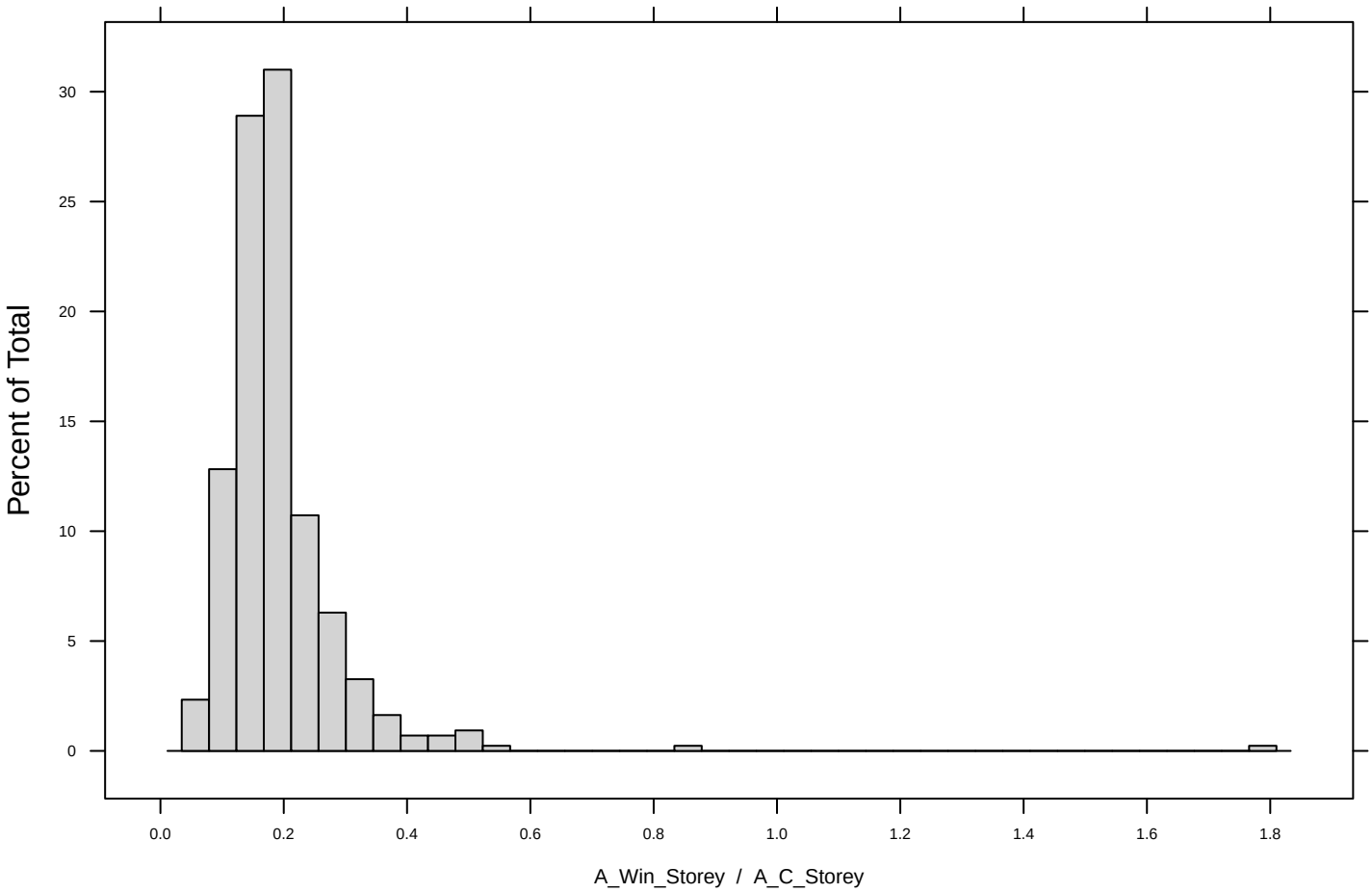
removed cases A_Roof (continuation)

Code_Building	A_C_Storey	A_Roof	A_Roof/A_C_Storey	Corr
IE.N.TH.01.MassConc.ReEx.001	40.50000	43.8	1.0814815	P
IE.N.TH.02.Gen.ReEx.001	41.60000	45.7	1.0985577	P
IE.N.SFH.02.HBlock.ReEx.001	141.70000	87.7	0.6189132	P
IE.N.TH.05.Gen.ReEx.001	56.55000	61.7	1.0910698	P
IE.N.AB.03.Gen.ReEx.001	156.64000	164.8	1.0520940	P
XX.N.SFH.01.Gen.ReEx.001	75.42857	83.1	1.1017045	P
XX.N.SFH.02.Gen.ReEx.001	75.42857	83.1	1.1017045	P
XX.N.SFH.03.Gen.ReEx.001	75.42857	83.1	1.1017045	P
XX.N.MFH.01.Gen.ReEx.001	1666.50000	501.2	0.3007501	P
XX.N.MFH.02.Gen.ReEx.001	1666.50000	501.2	0.3007501	P
XX.N.MFH.03.Gen.ReEx.001	1666.50000	501.2	0.3007501	P
SI.N.SFH.02.Un_refur.ReEx.001	126.66667	126.5	0.9986842	P
SI.N.SFH.02.Med_refur.ReEx.001	126.66667	126.5	0.9986842	P
SI.N.SFH.02.Full_refur.ReEx.001	126.66667	126.5	0.9986842	P
SI.N.SFH.03.Un_refur.ReEx.001	90.50000	91.7	1.0132597	P
SI.N.SFH.03.Med_refur.ReEx.001	90.50000	91.7	1.0132597	P
SI.N.SFH.03.Full_refur.ReEx.001	90.50000	91.7	1.0132597	P
SI.N.SFH.05.Standard.ReEx.001	95.00000	69.1	0.7273684	P
SI.N.SFH.05.High_stand.ReEx.001	95.00000	69.1	0.7273684	P
SI.N.SFH.05.Low_E.ReEx.001	95.00000	69.1	0.7273684	P
SI.N.SFH.06.High_stand.ReEx.001	143.40000	74.2	0.5174338	P
SI.N.SFH.06.Low_E.ReEx.001	143.40000	74.2	0.5174338	P
SI.N.MFH.02.Un_refur.ReEx.001	72.40000	70.0	0.9668508	P
SI.N.MFH.02.Med_refur.ReEx.001	72.40000	70.0	0.9668508	P
SI.N.MFH.02.Full_refur.ReEx.001	72.40000	70.0	0.9668508	P
SI.N.MFH.05.Standard.ReEx.001	330.85000	246.2	0.7441439	P
SI.N.MFH.05.High_stand.ReEx.001	330.85000	246.2	0.7441439	P
SI.N.MFH.05.Low_E.ReEx.001	330.85000	246.2	0.7441439	P
SI.N.MFH.06.High_stand.ReEx.001	462.75000	417.8	0.9028633	P
SI.N.MFH.06.Low_E.ReEx.001	462.75000	417.8	0.9028633	P
SI.N.AB.01.Gen.ReEx.001	202.07692	220.0	1.0886943	P
SI.N.MFH.01.Gen.ReEx.001	290.00000	303.0	1.0448276	P
SI.N.MFH.02.Gen.ReEx.001	42.19231	283.0	6.7073838	P
SI.N.MFH.05.Gen.ReEx.001	330.85000	246.2	0.7441439	P
SI.N.MFH.06.Gen.ReEx.001	462.75000	417.8	0.9028633	P
SI.N.SFH.03.Gen.ReEx.001	90.50000	91.7	1.0132597	P
SI.N.SFH.05.Gen.ReEx.001	95.00000	69.1	0.7273684	P
SI.N.SFH.06.Gen.ReEx.001	143.50000	126.4	0.8808362	P
SI.N.TH.04.Gen.ReEx.001	234.00000	133.2	0.5692308	P
SI.N.TH.05.Gen.ReEx.001	174.00000	162.7	0.9350575	P
SI.N.TH.06.Gen.ReEx.001	188.00000	104.2	0.5542553	P

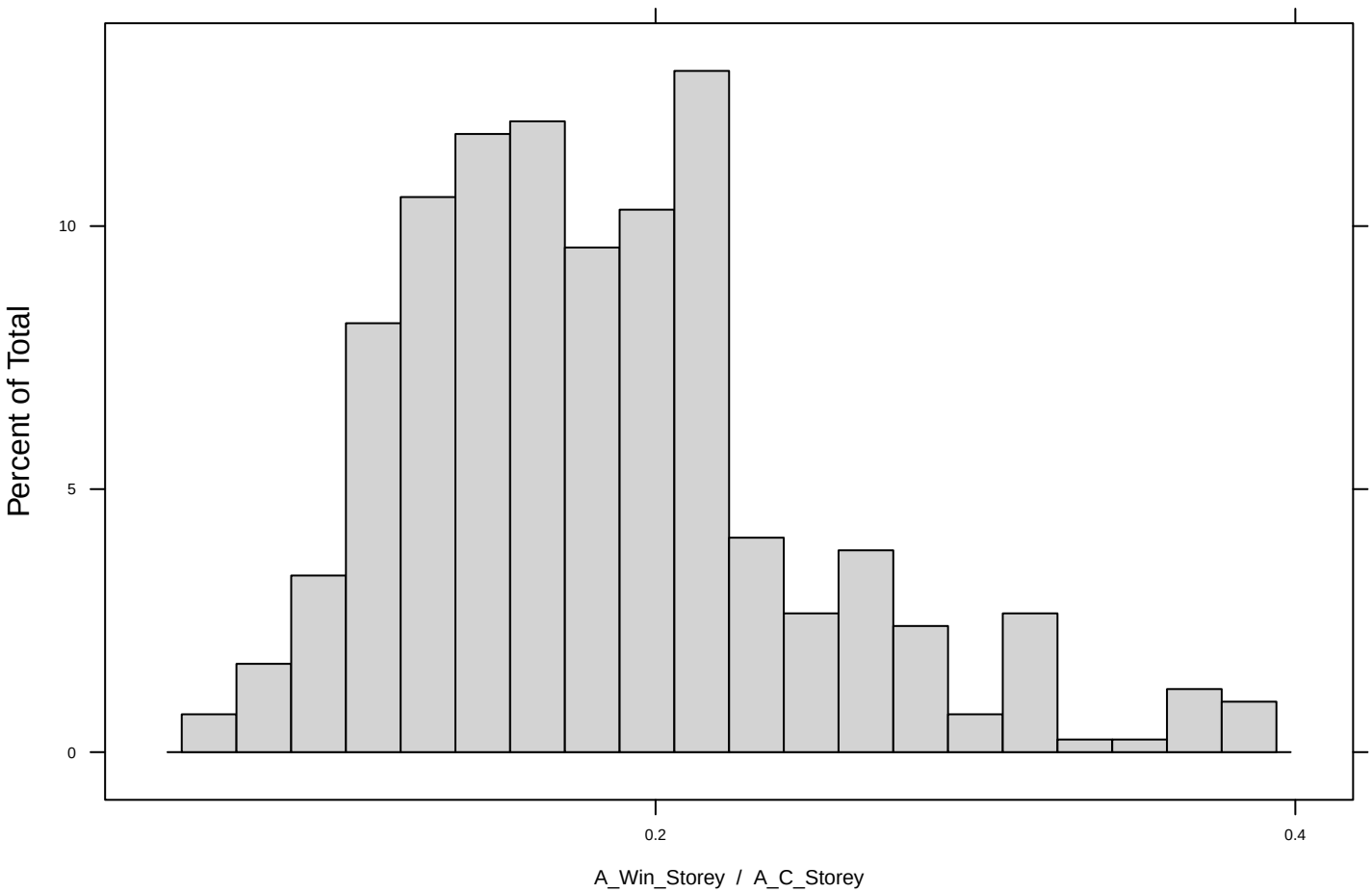
A_Roof / RoofType!=UC no correction required

A_Roof / RoofType=UC no correction required

Number of cases: 429 without data correction

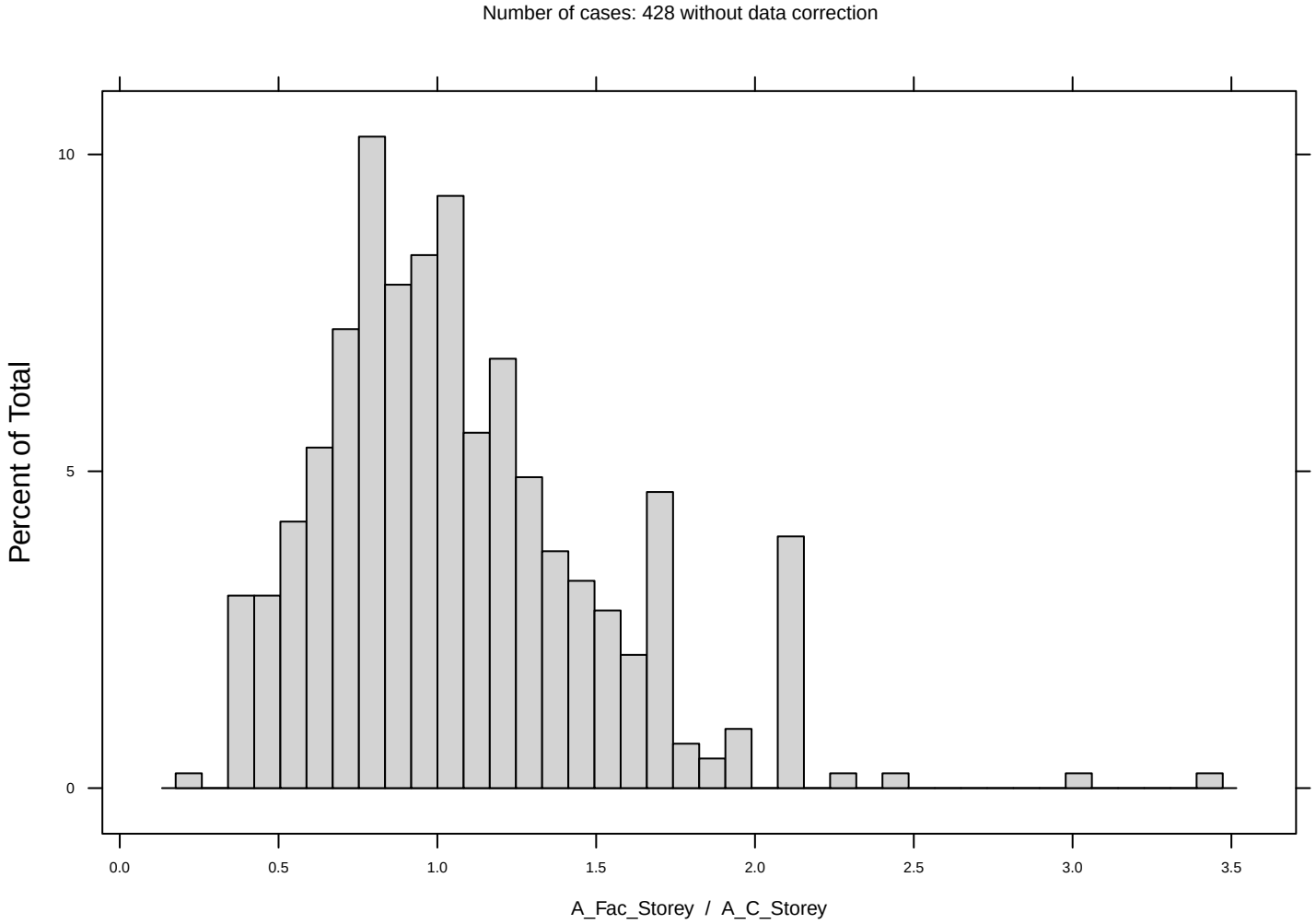


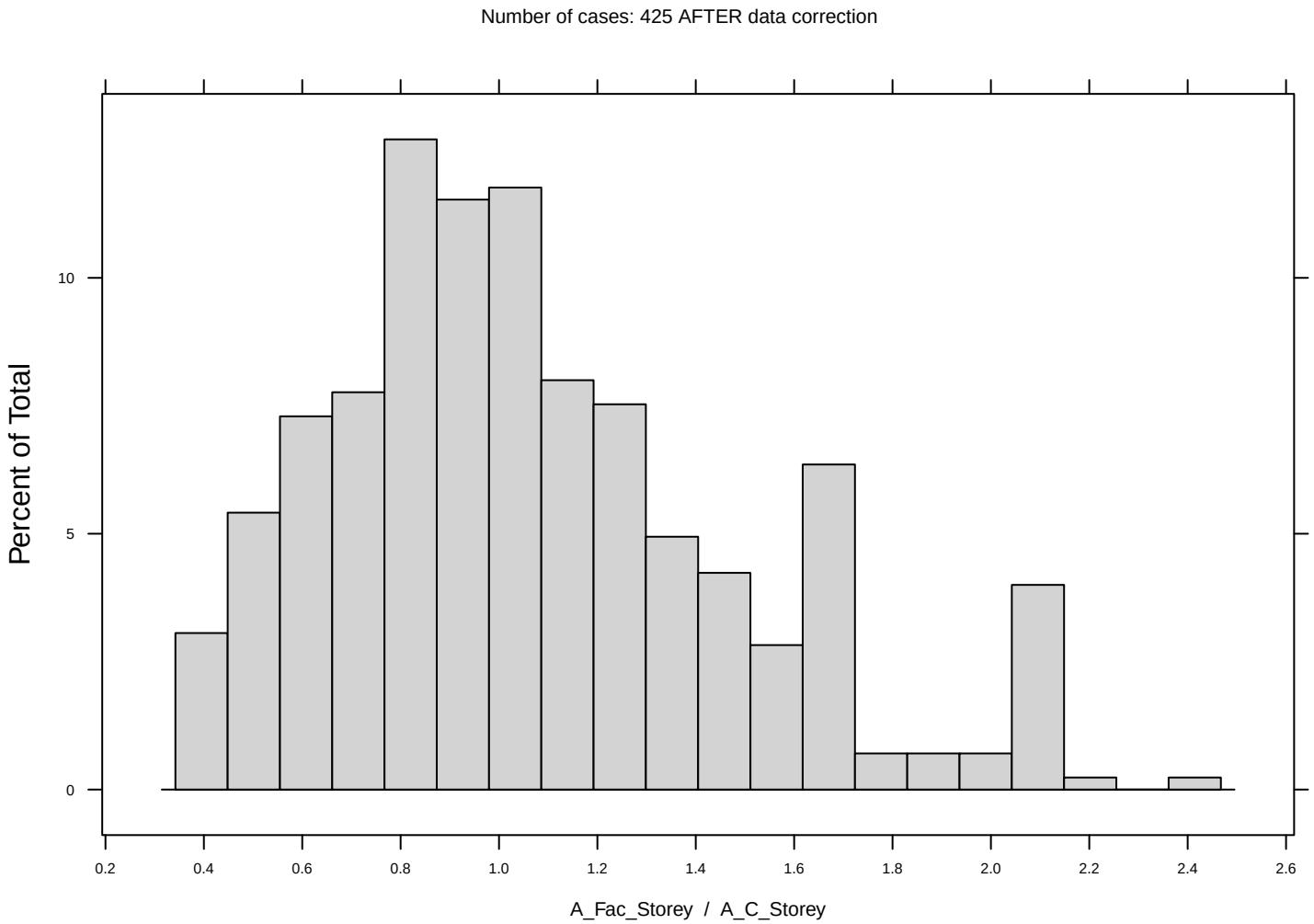
Number of cases: 417 AFTER data correction



removed cases A_Window per effective storey

Code_Building	A_Window/A_C_Ref	A_C_Storey	A_Win_Storey	A_C_Ref	A_Window	Corr
SI.N.SFH.06.High_stand.ReEx.001	0.03451883			286.8	9.9	P
SI.N.SFH.06.Low_E.ReEx.001	0.03451883			286.8	9.9	P
DK.N.TH.05.Gen.ReEx.001	0.43422584	42.95000	18.65000			Out
BE.N.AB.02.Gen.ReEx.001	0.45938375	79.33333	36.44444			Out
GR.ZoneD.MFH.01.Gen.ReEx.001	0.45955882	163.20000	75.00000			Out
BE.N.AB.03.Gen.ReEx.001	0.48523822	1043.61111	506.40000			Out
SI.N.SFH.01.Gen.ReEx.001	0.49668874	75.50000	37.50000			Out
GR.ZoneD.SFH.01.Gen.ReEx.001	0.49742931	155.60000	77.40000			Out
BE.N.MFH.04.Gen.ReEx.001	0.50850754			1028.5	523.0	P
BE.N.AB.05.Gen.ReEx.001	0.56428571			3094.0	1745.9	P
BE.N.MFH.02.Gen.ReEx.001	0.86441622			1795.2	1551.8	P
BE.N.MFH.03.small.ReEx.001	1.81008403			178.5	323.1	P


Number of cases: 428 without data correction
Percent of Total
10
5
0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
A_Fac_Storey / A_C_Storey


Number of cases: 425 AFTER data correction
Percent of Total
10
5
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
A_Fac_Storey / A_C_Storey

removed cases A_Facade (A_Wall+A_Window) per effective storey

Code_Building	A_Facade/A_C_Ref	A_C_Storey	A_Fac_Storey	A_C_Ref	A_Facade	Corr
BE.N.MFH.03.Gen.ReEx.001	0.1759936			1381.3	243.1	P
GR.ZoneC.SFH.03.Gen.ReEx.001	3.0089186	47.84	143.9467			Out
BE.N.MFH.03.small.ReEx.001	3.4728291	59.50	206.6333			Out