



WINDOW ENERGY LABELING IN COOLING SEASON: Fenestration & glazed structures



Additional report

on TASK 3: Climate zones

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Thessaloniki, January 2010

ESTABLISHING CLIMATIC ZONES ON A EUROPEAN BASIS

On November 2009 Aristotle University of Thessaloniki (AUTH) delivered a final report for Task 3 of the research project “Window energy labeling for the cooling season”, which is funded by the European Aluminium Association.

Under this framework, AUTH thoroughly examined the climatic conditions prevailing in European cities and proposed a categorization into zones according to the region’s heating and cooling needs, which are depicted by the number of Cooling Degree Days and Heating Degree Days. The value of 500CDD was regarded as the threshold, above which the climate can be characterised as cooling dominated and in parallel, the value of 2500HDD (also found in literature) was regarded as the border for heating dominating climates. Lower values of HDD and CDD indicate lower energy needs for heating and cooling respectively. The proposed scheme is presented in Table 1 and Figure 1. It is worth mentioning that emphasis was given to mediterranean areas, where cooling –the objective of the joint research- is dominating.

However, taking into consideration the aspects of the EAA, a final scheme of 3 climatic zones on the basis of Heating Degree Days has been proposed. The final scheme is presented in Table 2 and Figure 2. The geographical distribution of the selected sites in the proposed climatic zones is presented in Figure 3.

In Annex A the classification of the examined cities into the 3 proposed zones are presented. The tables contain information regarding the population of the city, the Heating and Cooling Degree Days at a base temperature of 18oC and the mean annual global radiation incident on a horizontal plane. Additional information regarding the Cooling Degree Days at a base temperature of 10oC, as well as the Cooling Degree Hours at a base temperature of 20oC, 23oC and 27oC is also included.

Table 1. Presentation of the scheme proposed initially by AUTH for establishing climatic zones in the European region.

Zone	Description	Requirements
A	$CDD < 500$ and $HDD \geq 2500$	Low cooling needs, high heating needs
B	$CDD < 500$ and $1500 \leq HDD < 2500$	Low cooling needs, medium heating needs
C	$CDD < 500$ and $HDD < 1500$	Low cooling needs, low heating needs
D	$CDD \geq 500$ and $HDD > 1500$	Medium cooling needs, medium heating needs
E	$CDD \geq 500$ and $HDD < 1500$	High cooling needs, low heating needs

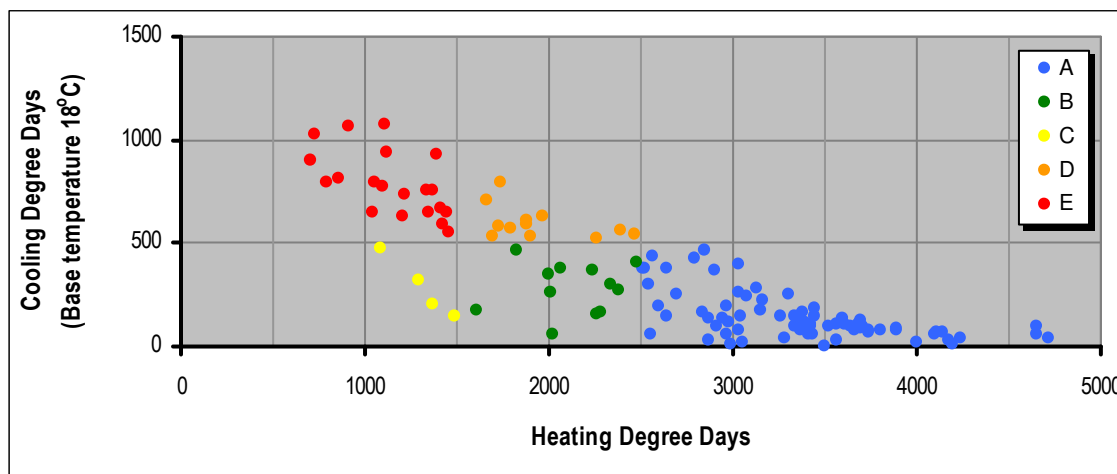


Figure 1. The classification of selected sites in the proposed climatic zones A to E..

Table 2. Presentation of the scheme proposed by EAA for establishing climatic zones in the European region.

Zone	Description	Requirements
1	$HDD \geq 3250$	High heating needs
2	$1500 \leq HDD < 3250$	Medium heating needs
D	$HDD < 1500$	Low heating needs

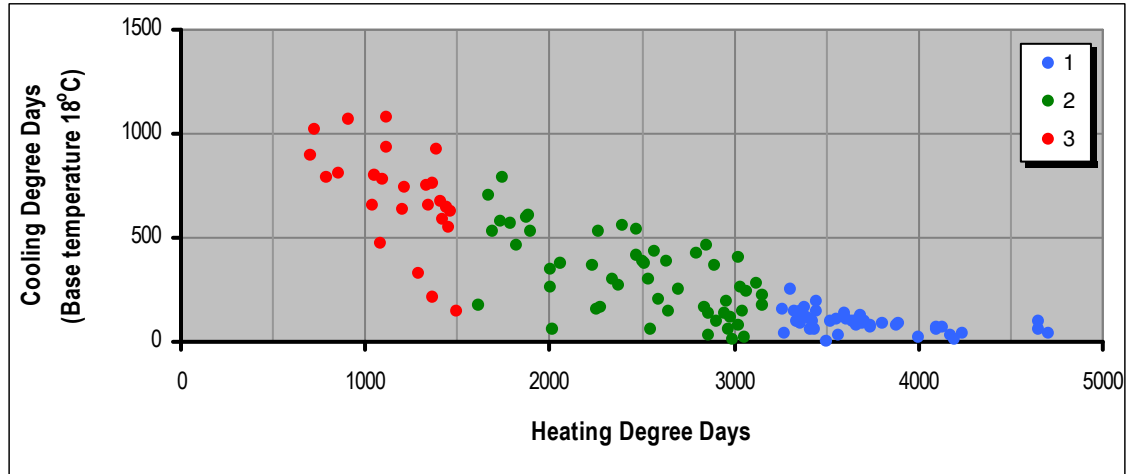


Figure 2. The classification of selected sites in climatic zones 1 to 3 proposed BY EAA.

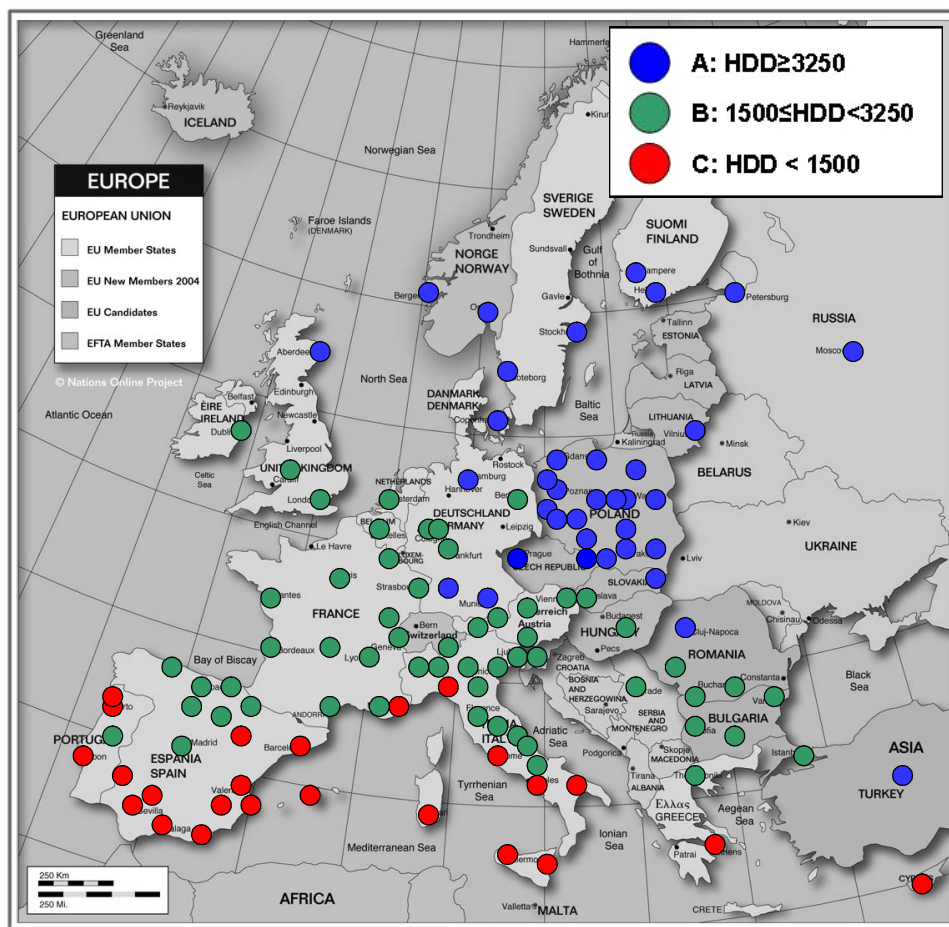


Figure 3. The geographical distribution of examined cities in the three climatic zones.

ZONE 1: HDD>3250

aa	Zone	city	country	population	HDD18	CDD18	Igl	CDD10	CDH20	CDH23	CDH27
1	1	Graz	AT	235477	3260	150	36539	1173	3472	1111	64
2	1	Innsbruck	AT	114561	3395	112	37565	1030	2977	1115	182
3	1	Linz	AT	185530	3361	148	36448	1099	3365	1273	211
4	1	Salzburg	AT	145680	3335	145	34806	1077	3378	1346	166
11	1	Ostrava	CZ	311402	3560	106	33393	992	2999	1111	199
12	1	Prague	CZ	1170571	3701	85	31461	906	2187	722	95
14	1	Bremen	DE	545932	3427	93	31382	842	2169	907	163
17	1	Hamburg	DE	1734830	3367	82	31309	864	1761	664	121
19	1	Munich	DE	1249176	3738	78	36827	868	2501	988	166
20	1	Stuttgart	DE	590657	3338	94	35846	975	2690	1025	216
21	1	Copenhagen	DK	501664	3563	30	32116	713	610	116	0
41	1	Helsinki	FI	559716	4712	34	31021	577	934	236	11
42	1	Tampere	FI	199823	5020	23	30187	528	720	127	0
54	1	Aberdeen Dyce	GB	203500	3503	2	28056	438	187	21	0
81	1	Kaunas	LT	368913	4136	71	32384	797	1738	471	14
83	1	Groningen	NL	179185	3278	40	31312	766	1108	332	50
84	1	Bergen	NO	237430	3998	21	24458	365	474	121	1
85	1	Oslo Fornebu	NO	521886	4172	33	28772	725	815	135	2
86	1	Bialystok	PL	292150	4101	55	29401	780	1906	584	88
87	1	Bydgoszcz	PL	368235	3742	70	28096	828	1865	527	38
88	1	Gdansk Port Polnocny	PL	459072	3438	62	29028	856	840	215	15
89	1	Gorzow Wilk	PL	125578	3446	145	27214	1039	3024	1239	263
90	1	Katowice	PL	319904	3711	92	33402	962	2223	712	112
91	1	Kielce	PL	209455	3887	78	32133	809	2116	769	121
92	1	Krakow	PL	757430	3682	103	33378	971	2589	969	199
93	1	Lodz	PL	774004	3692	127	32048	897	2864	1179	250
94	1	Lublin Radawiec	PL	355998	3808	82	31940	947	2222	708	66
95	1	Olsztyn	PL	173850	4105	72	28951	767	2007	664	38
96	1	Opole	PL	128864	3419	107	33236	1013	2536	892	152
97	1	Poznan	PL	570778	3522	100	32307	983	2523	904	133
98	1	Rzeszow Jasionka	PL	159020	3894	88	34466	895	2441	858	103
99	1	Szczecin	PL	411900	3412	62	28292	919	1391	427	49
100	1	Torun	PL	208278	3667	76	28437	895	1973	696	156
101	1	Warsaw	PL	1692854	3614	103	32725	950	2487	858	97
102	1	Zielona Gora	PL	118516	3641	97	28795	918	1981	702	95
108	1	Cluj-Napoca	RO	311528	3598	132	43567	1134	3290	1233	211
111	1	Moscow	RU	10524400	4654	100	31898	863	2129	729	78
112	1	Saint-Petersburg	RU	4661219	4654	59	29273	684	1101	296	14
115	1	Kosice	SK	235006	3451	188	36667	1188	3736	1476	208
116	1	Ljubljana	SI	267563	3385	168	35333	1130	4580	2017	426
117	1	Goteborg Landvetter	SE	466990	4199	10	32361	525	483	102	0
118	1	Stockholm	SE	761721	4239	36	30194	683	978	224	0
119	1	Ankara	TR	3203362	3308	254	48698	1337	6701	3094	731

ZONE 2: 1500<HDD<3250

aa	Zone	city	country	population	HDD18	CDD18	Igl	CDD10	CDH20	CDH23	CDH27
5	2	Vienna	AT	1598626	3158	223	36803	1305	4252	1622	246
6	2	Brussels	BE	999899	2911	95	30087	1008	2224	856	167
7	2	Plovdiv	BG	340538	2470	543	42246	1965	10512	5177	1487
8	2	Sofia	BG	1091772	3073	240	36527	1346	4926	2000	282
9	2	Varna	BG	312889	2518	375	38700	1671	6291	2376	253
10	2	Geneva	CH	184758	2964	193	38800	1181	4050	1671	278
13	2	Berlin	DE	3387828	3155	170	32305	1124	3318	1409	313
15	2	Dusseldorf	DE	572663	2865	131	30907	1142	2752	982	123
16	2	Frankfurt am Main	DE	646889	3046	148	33913	1146	3283	1261	241
18	2	Koln	DE	969709	3030	80	31699	1009	2472	865	99
26	2	Bilbao	ES	352317	1612	171	35376	1596	4166	1346	96
28	2	Logrono	ES	141568	2005	344	47349	1660	7408	3521	815
32	2	Oviedo	ES	209495	2020	54	37793	1193	1635	299	2
34	2	Pamplona	ES	191865	2279	168	46132	1348	5163	2156	315
38	2	Valladolid	ES	321713	2376	268	50853	1431	7545	3927	1099
39	2	Vitoria	ES	223702	2551	57	42567	1066	2763	794	52
40	2	Zaragoza	ES	638799	1789	570	50437	2022	11092	5831	1889
43	2	Bordeaux	FR	702522	2007	263	41495	1610	5560	2386	630
44	2	Clermont-Ferrand	FR	260762	2593	198	40397	1364	4776	2017	462
45	2	Dijon	FR	238309	2838	164	38626	1212	3798	1395	218
46	2	Lyon	FR	1226249	2539	301	39479	1483	5780	2601	607
47	2	Marseille	FR	1023973	1733	578	50684	2103	10087	4511	991
48	2	Montpellier	FR	412891	1692	530	48055	2111	9437	4282	1031
49	2	Nancy	FR	258525	2978	116	35735	1070	3226	1158	145
50	2	Nantes	FR	579131	2256	153	38832	1310	3495	1225	157
52	2	Paris Orly	FR	2181374	2645	143	35014	1209	3100	998	115
53	2	Strasbourg	FR	451240	2947	136	35770	1161	3277	1223	183
55	2	Birmingham	GB	992400	3056	21	33637	740	818	214	33
56	2	London Gatwick	GB	7429200	2868	32	33084	864	1430	370	32
58	2	Thessaloniki	GR	386627	1741	791	51353	2357	13992	6960	1903
59	2	Debrecen	HU	204293	3129	279	40917	1385	5770	2618	638
60	2	Dublin	IE	471841	2992	5	30966	638	118	6	0
61	2	Ancona-Falconara	IT	101797	2063	378	39068	1749	7189	3035	529
63	2	Bologna-Borgo Panigale	IT	374425	2393	557	37562	1978	10402	5185	1556
64	2	Brescia-Ghedi	IT	192164	2566	435	35197	1678	8081	3791	832
66	2	Campobasso	IT	51633	2700	249	43704	1385	4292	1511	192
68	2	Firenze-Peretola	IT	368059	1902	528	37532	2050	10383	5223	1534
69	2	Foggia	IT	154780	1668	703	41777	2286	13274	7202	2595
71	2	Milan	IT	1299439	2639	380	42328	1636	7419	3038	482
74	2	Perugia	IT	157842	2234	366	41346	1679	6808	2926	708
75	2	Pescara	IT	122577	1826	460	40122	1949	8471	3643	702
77	2	Torino	IT	902255	2507	381	42476	1648	6704	2581	375
78	2	Trieste	IT	207069	1881	592	34873	2123	9602	4029	786
79	2	Venice	IT	271251	2262	527	37812	1906	8435	3389	549
80	2	Verona-Villafranca	IT	259068	2474	411	35213	1752	7952	3521	689
82	2	Amsterdam	NL	739104	2970	61	32208	903	1383	511	101
103	2	Braganca	PT	170858	2340	297	51808	1461	6908	3459	1027
107	2	Bucharest	RO	1927448	3030	401	45571	1612	8902	4688	1436
109	2	Craiova	RO	299494	2849	466	45067	1727	9372	4702	1386
110	2	Timisoara	RO	303908	2897	365	44648	1579	7712	3673	926
113	2	Belgrade	RS	1576124	2798	423	44188	1698	8409	4067	1004
114	2	Bratislava	SK	425155	3036	262	39225	1399	5437	2328	445
120	2	Istanbul	TR	8803468	1885	609	45718	2150	9684	3611	460

ZONE 3: HDD<1500

aa	Zone	city	country	population	HDD18	CDD18	Igl	CDD10	CDH20	CDH23	CDH27
22	3	Alicante	ES	310330	855	810	57486	2890	15280	7519	2239
23	3	Almeria	ES	158902	702	899	58659	3121	16132	7520	1856
24	3	Badajoz	ES	139135	1333	753	56628	2451	15690	9325	3995
25	3	Barcelona	ES	1578546	1419	588	47939	2233	9195	3322	288
27	3	Cordoba	ES	314178	1121	936	56790	2799	19704	12100	5727
29	3	Madrid	ES	3099834	1465	628	53038	2057	13205	7715	3227
30	3	Malaga	ES	547731	796	791	57938	2919	14177	6574	1594
31	3	Murcia	ES	398815	1042	651	52502	2551	11623	4771	917
33	3	Palma	ES	376953	1214	740	54043	2547	13645	6453	1568
35	3	Santander	ES	183799	1369	208	40358	1847	2310	395	40
36	3	Sevilla	ES	704203	916	1064	58281	3128	21852	13383	6319
37	3	Valencia	ES	785732	1052	797	53565	2741	14304	6751	1620
51	3	Nice	FR	478850	1453	551	47972	2150	8517	2891	194
57	3	Athens	GR	796442	1112	1075	54781	2965	19248	10141	3059
62	3	Bari-Palese Macchie	IT	328458	1414	670	43425	2374	11198	4889	1042
65	3	Cagliari-Elmas	IT	161465	1206	631	44291	2453	10397	4258	737
67	3	Catania-Fontanarossa	IT	205773	1098	777	45923	2673	14201	6908	1668
70	3	Genova	IT	605084	1348	652	42454	2375	10027	3632	287
72	3	Naples	IT	995171	1365	755	48233	2486	13385	6121	1422
73	3	Palermo	IT	675277	724	1021	55181	3224	16614	7179	842
76	3	Rome	IT	2553873	1443	648	47960	2334	10931	4368	568
104	3	Coimbra	PT	142408	1294	324	51531	2041	6847	2971	755
105	3	Lisboa	PT	529485	1087	474	54076	2327	9781	4727	1183
106	3	Porto	PT	238954	1492	146	51407	1673	2874	928	133
121	3	Izmir	TR	2232265	1391	926	55415	2678	17564	9927	3735