

ESPR-r simulations

Basic model information:

ZONE	Volume [m ³]	Total surface area [m ²]	Floor area [m ²]	Total glazing area [m ²]	Glazing facing south [m ²]	Total ext.walls area [m ²]	Total ext.doors area [m ²]
Living room-kitchen	144	192	48	10	7.5	57	5
Bed room	48	80	16	2.5	0	21.5	0

Constructions U-Values:

CONSTRUCTIONS	THICKNESS [cm]	U VALUE [W/m ² K]
External wall	55	0.122
Ceiling	31	0.125
External door	7.5	0.518
Triple glazing	4.2	0.824

Case-study 1: UK climate (Glasgow)

Site location

Latitude (degrees)	longitude(degrees)
51.7	0.5

Ground temperature profile

JAN	FEB	MAR	APR	MAY	JUNE	JUL	AUG	SEPT	OCT	NOV	DEC
4.6	2.8	3.3	5.1	6.1	9.6	11.4	13.6	14.3	12.7	7.5	5.5

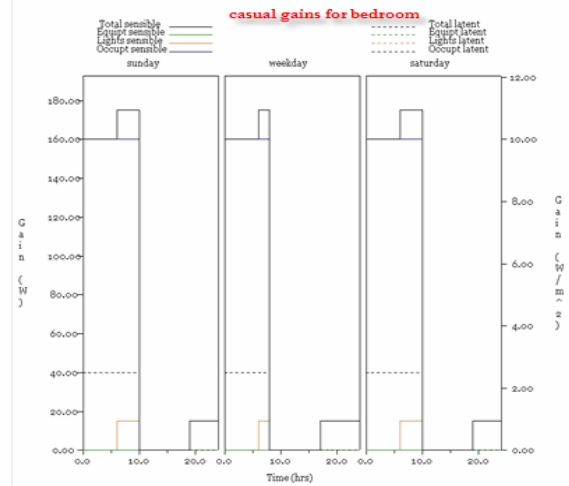
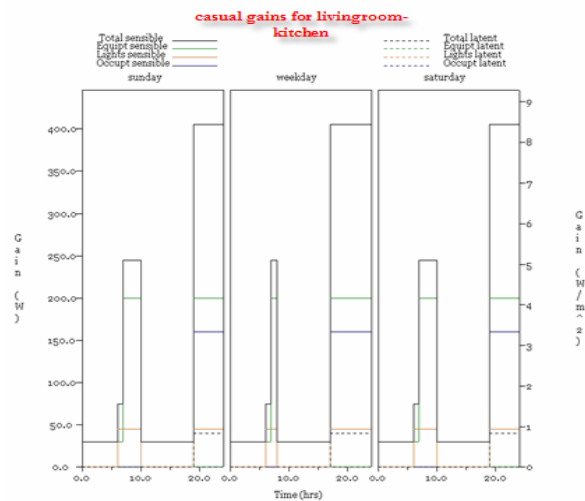
The maximum capacity: heating –cooling: 1 kW

Control data (active for the whole week)

HOURS	HEATING SETPOINT [°C]	COOLING SETPOINT [°C]
0 - 7	15	25
7 - 24	19	25

Casual gains

ZONES	CASUAL GAINS DISTRIBUTION [kWh]					NUMBER OF HOURS		
	OCCUPANCY	LIGHTS	EQUIPMENT	LIGHTS + EQUIPMENT	TOTAL	OCCUPANCY	LIGHTS	EQUIPMENT
Living room-kitchen	375,12	147,8	759,07	906,87	1281,99	2709	4014	8760
Bedroom	500,87	49,27	0	49,27	550,14	3495	4014	0
TOTAL	875,99	197,07	759,07	956,14	1832,13	6204	8028	8760

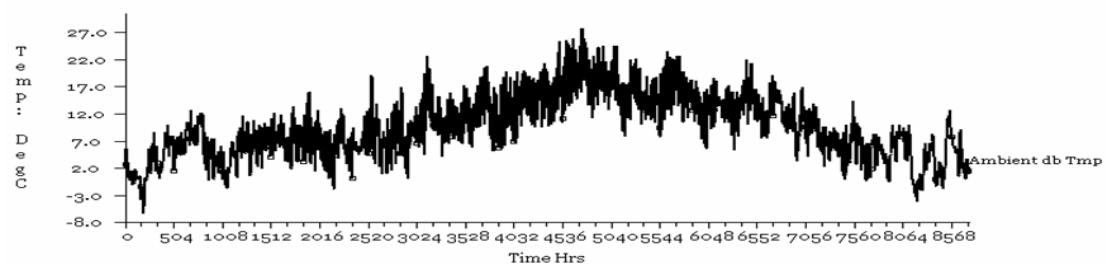


Simulation 1: Basic case

Heating & cooling demand - passive solar gains:

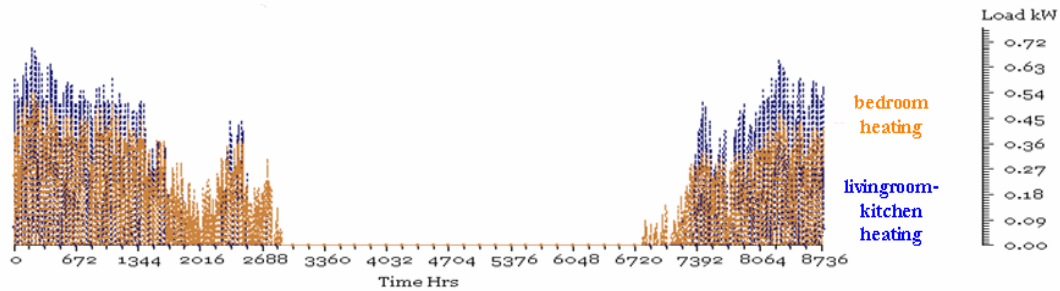
MONTHLY GAINS & LOSSES	HEATING [kWh]			COOLING [kWh]			PASSIVE SOLAR GAINS [kWh]		
	Living room-kitchen	Bed room	TOTAL	Living room-kitchen	Bed room	TOTAL	Living room-kitchen	Bed room	TOTAL
JANUARY	117,1	251,7	368,8	0,0	0,0	0,0	91,2	11,0	102,2
FEBRUARY	53,5	202,0	255,5	0,0	0,0	0,0	169,7	22,4	192,1
MARCH	19,6	117,3	136,9	0,0	0,0	0,0	382,5	58,6	441,1
APRIL	21,0	118,9	139,9	0,0	0,0	0,0	294,6	52,8	347,4
MAY	0,2	7,3	7,5	0,0	0,0	0,0	439,3	98,4	537,7
JUNE	0,0	0,0	0,0	-6,0	0,0	-6,0	418,3	112,4	530,7
JULY	0,0	0,0	0,0	-90,4	-0,2	-90,6	444,3	111,5	555,8
AUGUST	0,0	0,0	0,0	-46,5	0,0	-46,5	441,7	80,2	521,9
SEPTEMBER	0,3	4,4	4,7	0,0	0,0	0,0	219,4	37,8	257,2
OCTOBER	6,8	47,9	54,7	0,0	0,0	0,0	254,9	34,2	289,1
NOVEMBER	64,0	162,2	226,2	0,0	0,0	0,0	116,2	14,8	131,0
DECEMBER	101,2	223,8	325,0	0,0	0,0	0,0	86,5	9,5	96,0
ANNUAL	383,7	1135,5	1519,2	-142,9	-0,2	-143,1	3358,6	643,6	4002,2

Lib: annual.res: Results for bld_basic
 Period: Sun-01-Jan@00h30(1967) to Sun-31-Dec@23h30(1967) : sim@60m, output@60m
 Zones:



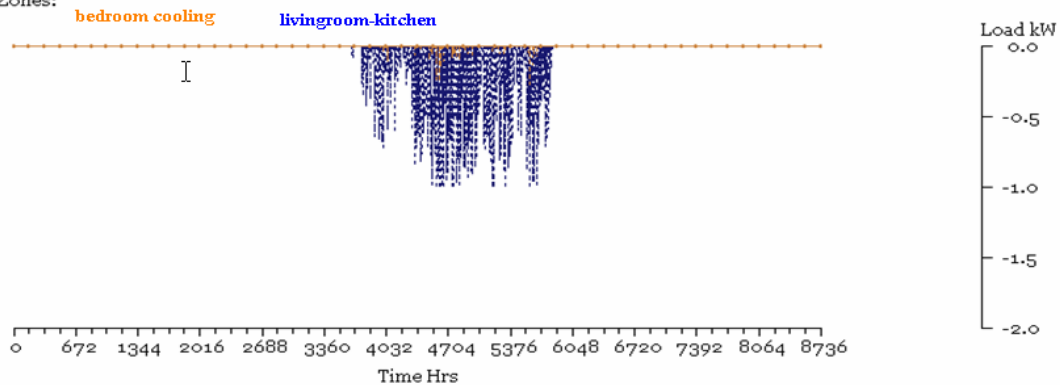
Graph 1: Ambient temperature in Glasgow

Lib: bld_basicyear.res: Results for bld_basic
 Period: Sun-01-Jan@00h30(1967) to Sun-31-Dec@23h30(1967) : sim@60m, output@60m
 Zones:



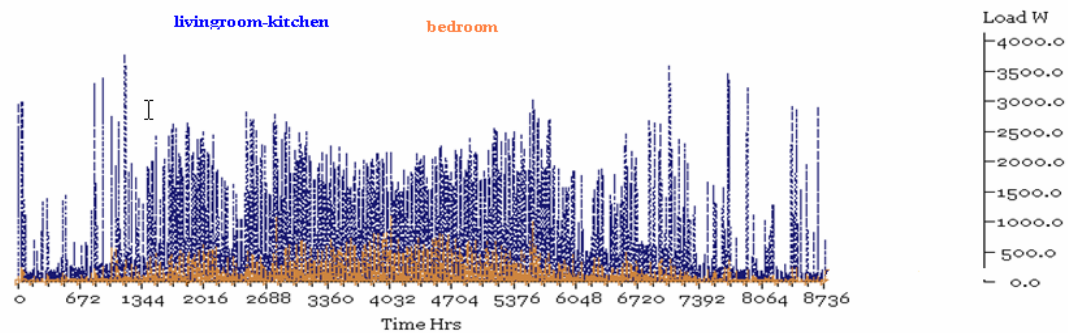
Graph 2: Heating load

Lib: bld_basicyear.res: Results for bld_basic
 Period: Sun-01-Jan@00h30(1967) to Sun-31-Dec@23h30(1967) : sim@60m, output@60m
 Zones:



Graph 3: Cooling load without natural ventilation

Lib: bld_basicyear.res: Results for bld_basic
 Period: Sun-01-Jan@00h30(1967) to Sun-31-Dec@23h30(1967) : sim@60m, output@60m
 Zones:

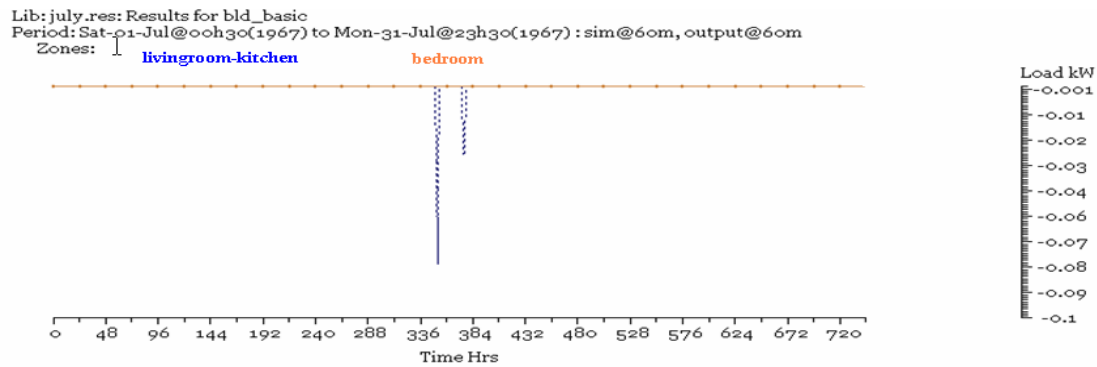


Graph 4: Solar absorbed in the 2 zones

Simulation 2: Use of natural (night-time) ventilation

SCHEDULED AIR FLOWS	INFILTRATION FROM THE ENVIRONMENT [ac/h]	
RECEPTION	0-10	2.00
	10-17	1.00
	17-24	2.00
OFFICE	0-10	0.50
	10-17	0.30
	17-24	0.50

Cooling demand → -0.2kWh



Graph 5: Cooling load after implementing natural ventilation

Simulation 3: Increase 80% in the size of the south facing window to decrease the heating demand

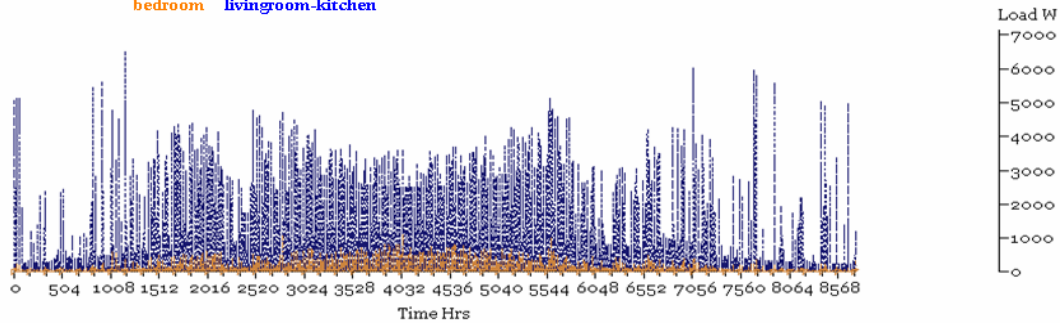
Heating & cooling demand - passive solar gains:

MONTHLY GAINS & LOSSES	HEATING [kWh]			COOLING [kWh]			PASSIVE SOLAR GAINS [kWh]		
	Living room- kitchen	bed room	TOTAL	Living room- kitchen	bed room	TOTAL	Living room- kitchen	bed room	TOTAL
JANUARY	89,7	202,5	292,2	0,0	0,0	0,0	152,4	11,1	163,5
FEBRUARY	34,1	139,5	173,6	0,0	0,0	0,0	282,0	22,6	304,6
MARCH	3,4	27,3	30,7	-0,2	0,0	-0,2	629,2	59,1	688,3
APRIL	4,6	37,7	42,3	0,0	0,0	0,0	481,4	53,2	534,6
MAY	0,0	0,0	0,0	-101,0	-0,1	-101,1	707,6	99,2	806,8
JUNE	0,0	0,0	0,0	-257,9	-4,1	-262,0	663,6	113,2	776,8
JULY	0,0	0,0	0,0	-295,0	-29,8	-324,8	708,9	112,3	821,2
AUGUST	0,0	0,0	0,0	-337,1	-15,8	-352,9	715,6	80,8	796,4
SEPTEMBER	0,0	0,0	0,0	-13,5	0,0	-13,5	357,1	38,1	395,2
OCTOBER	0,0	1,5	1,5	-3,4	0,0	-3,4	421,3	34,5	455,8
NOVEMBER	36,8	107,4	144,2	0,0	0,0	0,0	194,5	15,0	209,5
DECEMBER	81,9	174,2	256,1	0,0	0,0	0,0	145,7	9,6	155,3
ANNUAL	250,5	690,1	940,6	-1008,1	-49,8	-1057,9	5459,3	648,7	6108,0



Graph 6: Heating demand with 80% increase in the south facing window's size

Lib: annual.res: Results for bld_basic
 Period: Sun-01-Jan@00h30(1967) to Sun-31-Dec@23h30(1967) : sim@60m, output@60m
 Zones: bedroom livingroom-kitchen



Graph 7: Passive solar gains with 80% increase in the south facing window's size

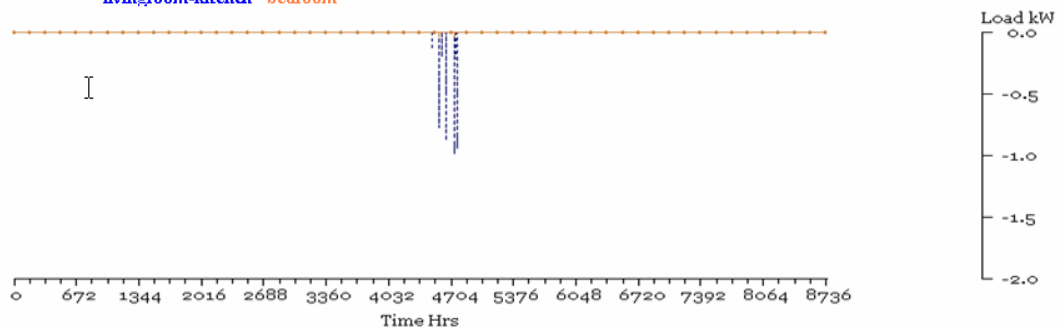
Simulation 4: Use of shading & natural ventilation after having increased the size of the south facing window

Shading → 30% decrease in the size of south facing window

Natural ventilation

SCHEDULED AIR FLOWS	INFILTRATION [ac/h]	
Living room-kitchen & bed room	0-10	2.00
	10-17	1.00
	17-24	2.00

Lib: annual.res: Results for bld_basic
 Period: Sun-01-Jan@00h30(1967) to Sun-31-Dec@23h30(1967) : sim@60m, output@60m
 Zones: livingroom-kitchen bedroom



Graph 8: Cooling demand after implementing shading effect & natural ventilation

Cooling demand → -14.9kWh

Simulation 5: Increased window - improved floor U-Value through better insulation - max indoor Temperature levels increased to 27C

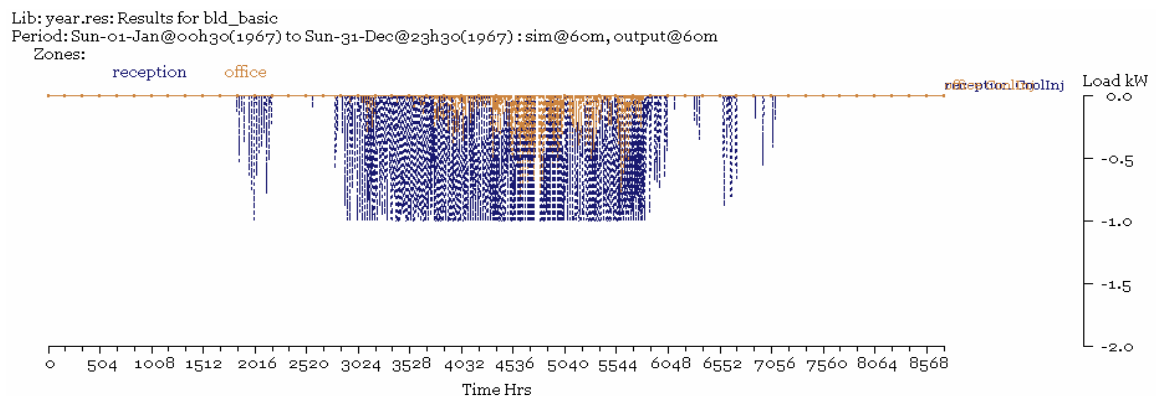
CONSTRUCTIONS	THICKNESS [cm]	U VALUE [W/m2K]
External wall	55	0.122
Ceiling	31	0.125
External door	7.5	0.518
Triple glazing	4.2	0.824
Floor	51	0.226

Control data

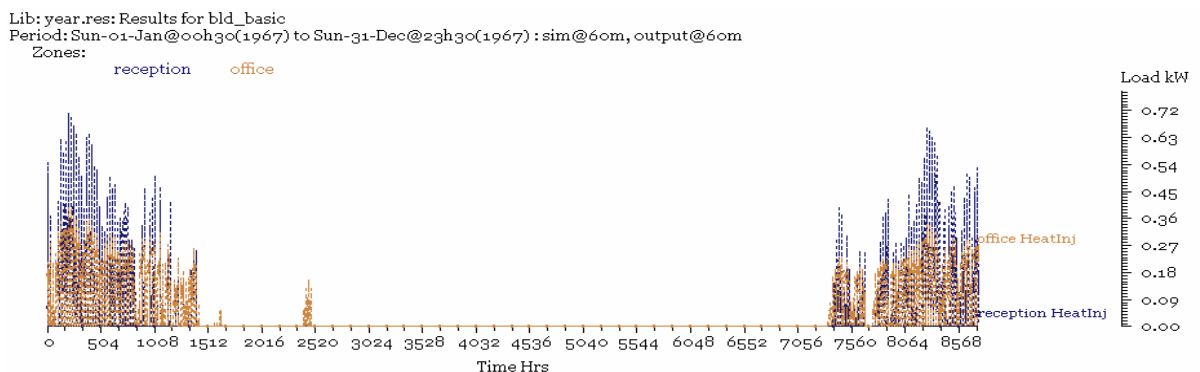
HOURS	HEATING SETPOINT [°C]	COOLING SETPOINT [°C]
0 - 7	15	27
7 - 24	19	27

Heating & cooling demand - passive solar gains:

MONTHLY GAINS & LOSSES	HEATING [kWh]			COOLING [kWh]			PASSIVE SOLAR GAINS [kWh]		
	Living room- kitchen	Bedro m	TOTAL	Living room- kitchen	Bedro m	TOTAL	Living room- kitchen	bedro m	TOTAL
JANUARY	76.1	123.6	199.7	0.0	0.0	0.0	152.4	11.1	163.5
FEBRUARY	16.1	59.8	75.9	0.0	0.0	0.0	282.0	22.6	304.6
MARCH	0.0	0.6	0.6	-28.3	0.0	-28.3	629.2	59.1	688.3
APRIL	0.0	2.6	2.6	-5.3	0.0	-5.3	481.4	53.2	534.6
MAY	0.0	0.0	0.0	-245.6	-3.6	-249.2	707.6	99.2	806.8
JUNE	0.0	0.0	0.0	-371.1	-19.1	-390.2	663.6	113.2	776.8
JULY	0.0	0.0	0.0	-305.7	-71.2	-376.9	708.9	112.3	821.2
AUGUST	0.0	0.0	0.0	-385.5	-42.3	-427.8	715.6	80.8	796.4
SEPTEMBER	0.0	0.0	0.0	-29.1	0.0	-29.1	357.1	38.1	395.2
OCTOBER	0.0	0.0	0.0	-16.0	0.0	-16.0	421.3	34.5	455.8
NOVEMBER	20.8	52.3	73.1	0.0	0.0	0.0	194.5	15.0	209.5
DECEMBER	67.3	106.0	173.3	0.0	0.0	0.0	145.7	9.6	155.3
ANNUAL	180.3	344.9	525.2	-1386.6	-136.2	-1522.8	5459.3	648.7	6108.0



Graph 9: Heating demand with 80% increase in the south facing window's size – improved floor U-Value & control to 27°C



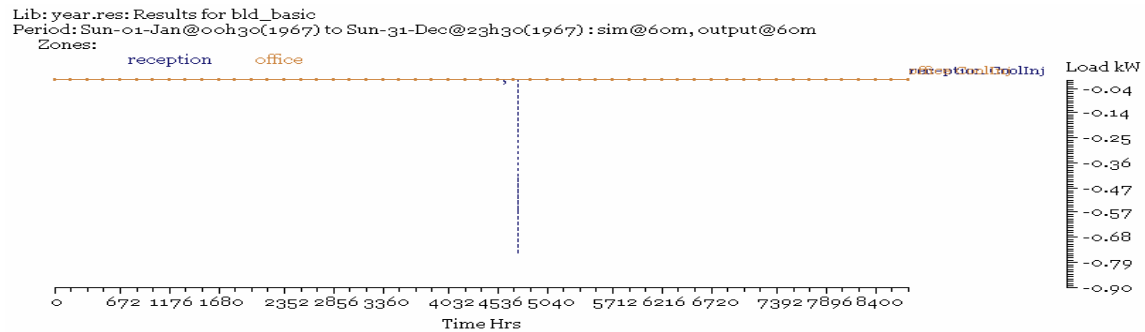
Graph 10: Cooling demand with 80% increase in the south facing window's size – improved floor U-Value & control to 27°C

Simulation 6: Use of shading & natural ventilation after having improved floor U-Value & max indoor Temperature levels increased to 27C

Shading → 30% decrease in the size of south facing window

Natural ventilation

SCHEDULED AIR FLOWS	INFILTRATION [ac/h]	
Living room-kitchen & bed room	0-10	2.00
	10-17	1.00
	17-24	2.00



Graph 11: Cooling demand after introducing shading effect & natural ventilation with 80% increase in the south facing window's size – improved floor U-Value & control to 27°C

Cooling demand → **-2.0kWh**

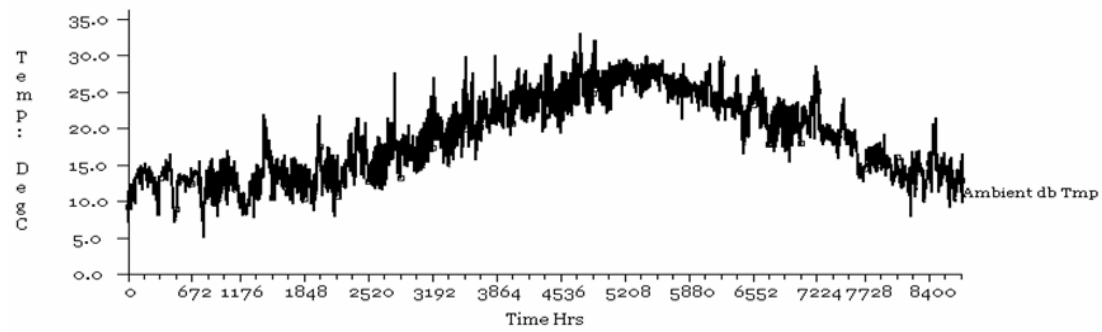
Case-study 2: Southern Europe climate (Palermo, Italy)

Simulation 1: Basic case

Latitude (degrees)	Longitude (degrees)
38.2	1.9

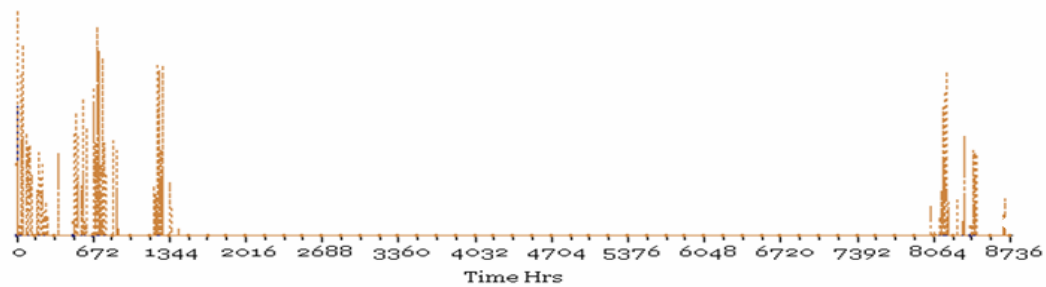
MONTHLY GAINS & LOSSES	HEATING [kWh]			COOLING [kWh]			PASSIVE SOLAR GAINS [kWh]		
	Living room-kitchen	bed room	TOTAL	Living room-kitchen	bed room	TOTAL	Living room-kitchen	bed room	TOTAL
JANUARY	0,3	9,6	9,9	0,0	0,0	0,0	412,7	55,6	468,3
FEBRUARY	0,0	3,5	3,5	-1,7	0,0	-1,7	448,0	73,0	521,0
MARCH	0,0	0,0	0,0	-17,0	0,0	-17,0	491,1	109,8	600,9
APRIL	0,0	0,0	0,0	-53,2	-0,3	-53,5	455,8	135,0	590,8
MAY	0,0	0,0	0,0	-72,2	-2,9	-75,1	407,5	157,3	564,8
JUNE	0,0	0,0	0,0	-118,9	-16,1	-135,0	369,7	164,5	534,2
JULY	0,0	0,0	0,0	-392,5	-94,1	-486,6	405,3	173,5	578,8
AUGUST	0,0	0,0	0,0	-660,4	-178,9	-839,3	480,4	158,5	638,9
SEPTEMBER	0,0	0,0	0,0	-207,7	-34,7	-242,4	498,5	123,7	622,2
OCTOBER	0,0	0,0	0,0	-90,2	-13,1	-103,3	549,2	102,1	651,3
NOVEMBER	0,0	0,0	0,0	-12,1	0,0	-12,1	357,1	53,8	410,9
DECEMBER	0,0	3,8	3,8	0,0	0,0	0,0	370,3	51,0	421,3
ANNUAL	0,0	16,9	16,9	-1625,9	-340,1	1966,0	5245,6	1357,8	6603,4

Lib: annual.res: Results for bld_basic
 Period: Mon-01-Jan@00h30(2001) to Mon-31-Dec@23h30(2001) : sim@60m, output@60m
 Zones: livingroom-kitchen bedroom



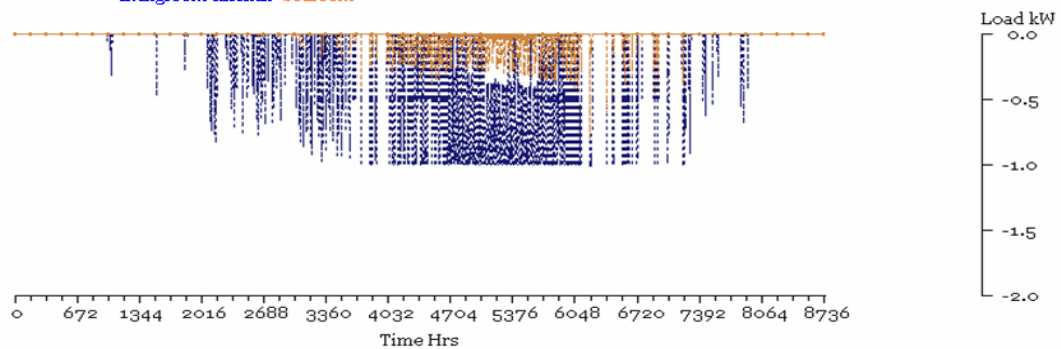
Graph 12: Ambient temperature in Palermo

Lib: annual.res: Results for bld_basic
 Period: Mon-01-Jan@00h30(2001) to Mon-31-Dec@23h30(2001) : sim@60m, output@60m
 Zones: livingroom-kitchen bedroom



Graph 13: Heating load

Lib: annual.res: Results for bld_basic
 Period: Mon-01-Jan@00h30(2001) to Mon-31-Dec@23h30(2001) : sim@60m, output@60m
 Zones: livingroom-kitchen bedroom



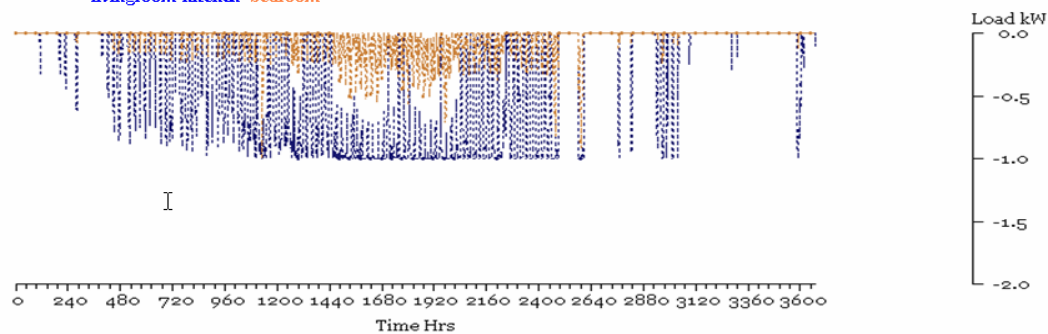
Graph 14: Cooling load without natural ventilation

Simulation 2: Use of natural (night-time) ventilation

SCHEDULED AIR FLOWS	INFILTRATION FROM THE ENVIRONMENT [ac/h]	
Living room-kitchen & bed room	0-6	10.0
	6-10	1.0
	10-19	0.03
	19-22	1.0
	22-24	10.0

MONTHLY GAINS & LOSSES	COOLING [kWh]		
	Living room-kitchen	bed room	TOTAL
JUNE	-68,4	-6,0	-74,4
JULY	-319,6	-31,4	-351,0
AUGUST	-638,6	-116,0	-754,6
SEPTEMBER	-204,2	-34,4	-238,6
OCTOBER	-45,4	-1,7	-47,1
ANNUAL	-1276,2	-189,5	-1465,7

Lib: hot period.res: Results for bld_basic
Period: Fri-01-Jun@00h30(2001) to Wed-31-Oct@23h30(2001) : sim@60m, output@60m
Zones: livingroom-kitchen bedroom

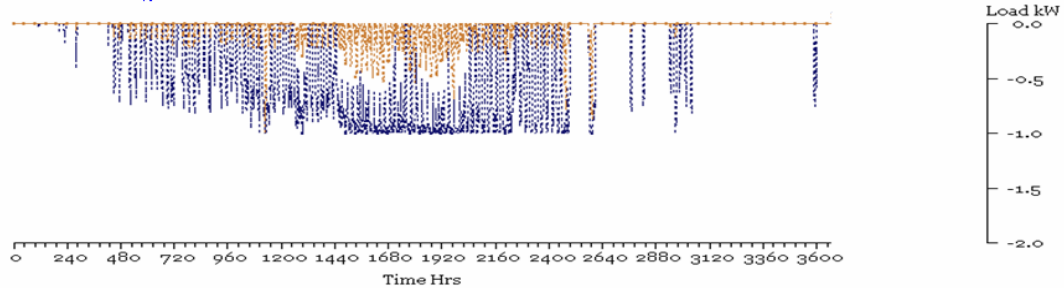


Graph 15: Cooling load after implementing natural ventilation

Simulation 3: Use of shading (25% decrease in the size of the south-facing window) to reduce cooling load

MONTHLY GAINS & LOSSES	COOLING [kWh]			PASSIVE SOLAR GAINS [kWh]		
	Living room-kitchen	bed room	TOTAL	Living room-kitchen	bed room	TOTAL
JUNE	-45,9	-5,2	-51,1	309,4	164,5	473,9
JULY	-263,4	-28,7	-292,1	339,0	173,5	512,5
AUGUST	-606,4	-94,3	-700,7	393,8	158,5	552,3
SEPTEMBER	-186,5	-24,0	-210,5	398,8	123,7	522,5
OCTOBER	-26,9	-0,4	-27,3	433,0	102,1	535,1
ANNUAL	-1129,1	-152,6	-1281,7	1874,0	722,3	2596,3

Lib: hot period.res: Results for bld_basic
 Period: Fri-01-Jun@00h30(2001) to Wed-31-Oct@23h30(2001) : sim@6om, output@6om
 Zones: livingroom-kitchen bedroom

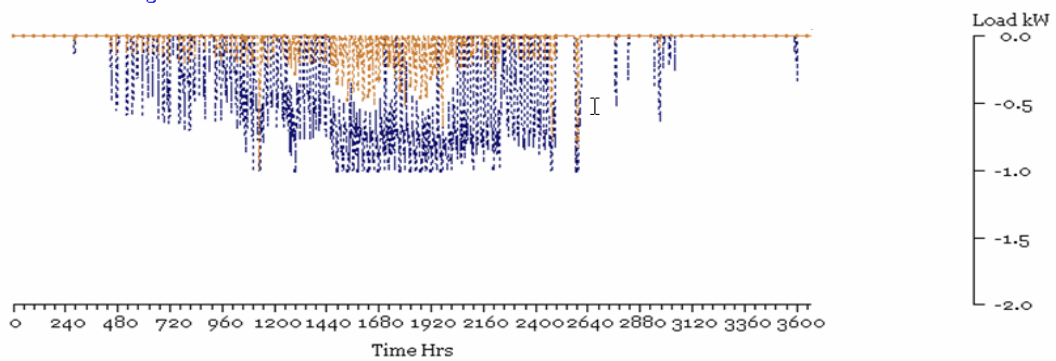


Graph 16: Cooling load after natural ventilation & 25% reduction in south facing window

Simulation 4: Further shading increase (50% decrease in the size of the south-facing window)

MONTHLY GAINS & LOSSES	COOLING [kWh]			PASSIVE SOLAR GAINS [kWh]		
	Living room-kitchen	bed room	TOTAL	Living room-kitchen	bed room	TOTAL
JUNE	-27,6	-4,4	-32,0	248,5	164,5	413,0
JULY	-205,0	-26,5	-231,5	272,0	173,5	445,5
AUGUST	-527,6	-85,7	-613,3	306,1	158,5	464,6
SEPTEMBER	-147,9	-19,4	-167,3	297,8	123,7	421,5
OCTOBER	-8,6	-0,2	-8,8	315,0	102,1	417,1
ANNUAL	-916,7	-136,2	-1052,9	1439,4	722,3	2161,7

Lib: hot period.res: Results for bld_basic
 Period: Fri-01-Jun@00h30(2001) to Wed-31-Oct@23h30(2001) : sim@6om, output@6om
 Zones: livingroom-kitchen bedroom



Graph 17: Cooling load after natural ventilation & 50% reduction in south facing window

Simulation 5: Thermal mass exploitation of wall structure

CONSTRUCTIONS	THICKNESS [cm]	U VALUE [W/m2K]
External wall	55	0.164
Ceiling	31	0.125
External door	7.5	0.518
Triple glazing	4.2	0.824

HOURS	HEATING SETPOINT [°C]	COOLING SETPOINT [°C]
0 - 7	15	27
7 - 24	19	27

Scenario A: Ventilation 0.03

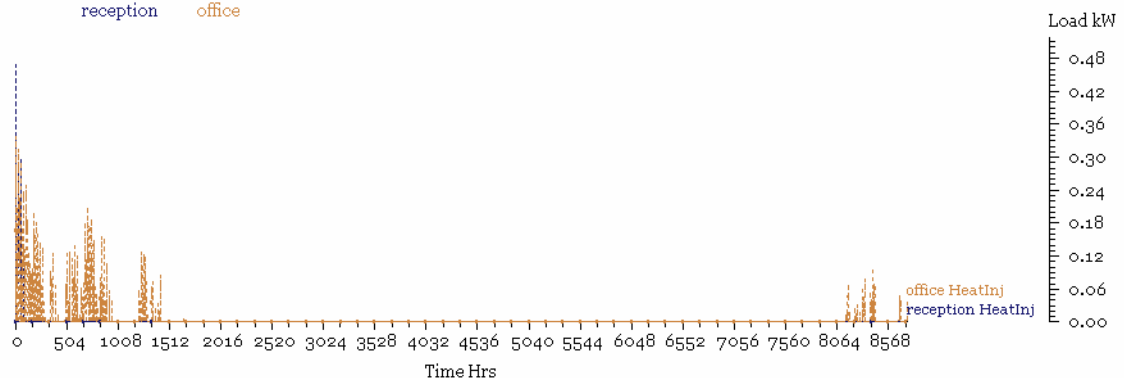
MONTHLY GAINS & LOSSES	HEATING [kWh]			COOLING [kWh]			PASSIVE SOLAR GAINS [kWh]		
	Living room- kitchen	bed room	TOTAL	Living room- kitchen	bed room	TOTAL	Living room- kitchen	bed room	TOTAL
JANUARY	2.6	26.8	29.4	0.0	0.0	0.0	408.1	55.1	463.2
FEBRUARY	0.0	5.8	5.8	0.0	0.0	0.0	443.0	72.4	515.4
MARCH	0.0	0.2	0.2	0.0	0.0	0.0	485.6	108.8	594.4
APRIL	0.0	0.0	0.0	0.0	0.0	0.0	450.7	133.7	584.4
MAY	0.0	0.0	0.0	0.0	0.0	0.0	402.9	155.9	558.8
JUNE	0.0	0.0	0.0	-12.4	-0.8	-13.2	365.6	163.0	528.6
JULY	0.0	0.0	0.0	-154.3	-9.9	-164.2	400.8	171.9	572.7
AUGUST	0.0	0.0	0.0	-314.6	-19.3	-333.9	475.0	157.0	632.0
SEPTEMBER	0.0	0.0	0.0	-54.4	-8.1	-62.5	492.9	122.6	615.5
OCTOBER	0.0	0.0	0.0	-33.0	-0.7	-33.7	543.1	101.1	644.2
NOVEMBER	0.0	0.0	0.0	0.0	0.0	0.0	353.2	53.3	406.5
DECEMBER	0.0	2.6	2.6	0.0	0.0	0.0	366.2	50.5	416.7
ANNUAL	0.0	35.4	38.0	-568.7	-38.8	-607.5	5187.1	1345.3	6532.4

Lib: annual.res: Results for bld_basic

Period: Mon-01-Jan@00h30(2001) to Mon-31-Dec@23h30(2001): sim@60m, output@60m

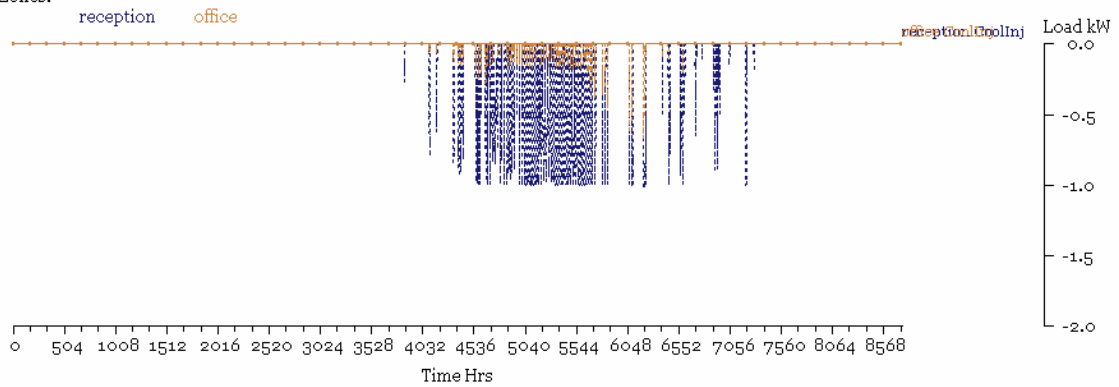
Zones:

reception office



Graph 18: Heating load after thermal mass exploitation of the wall structure

Lib: annual.res: Results for bld_basic
Period: Mon-01-Jan@00h30(2001) to Mon-31-Dec@23h30(2001) : sim@60m, output@60m
Zones:



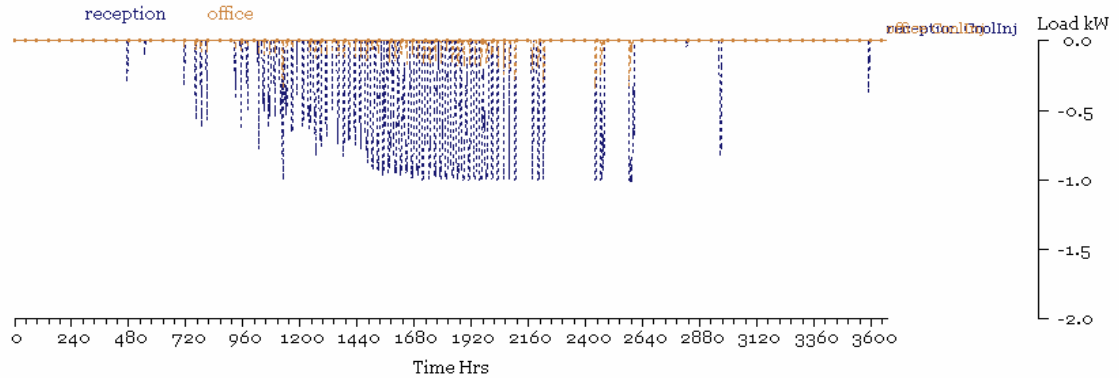
Graph 19: Cooling load after thermal mass exploitation of the wall structure

Scenario B: Use of natural (night-time) ventilation

SCHEDULED AIR FLOWS	INFILTRATION FROM THE ENVIRONMENT [ac/h]	
Living room-kitchen & bed room	0-6	5.0
	6-10	1.0
	10-19	0.3
	19-22	1.0
	22-24	5.0

MONTHLY GAINS & LOSSES	COOLING [kWh]		
	Living room-kitchen	bed room	TOTAL
JUNE	-2.1	-0.1	-2.2
JULY	-91.8	-5.4	-97.2
AUGUST	-313.9	-15.8	-329.7
SEPTEMBER	-38.9	-4.0	-42.9
OCTOBER	-6.9	0.0	-6.9
ANNUAL	-453.6	-25.3	-478.9

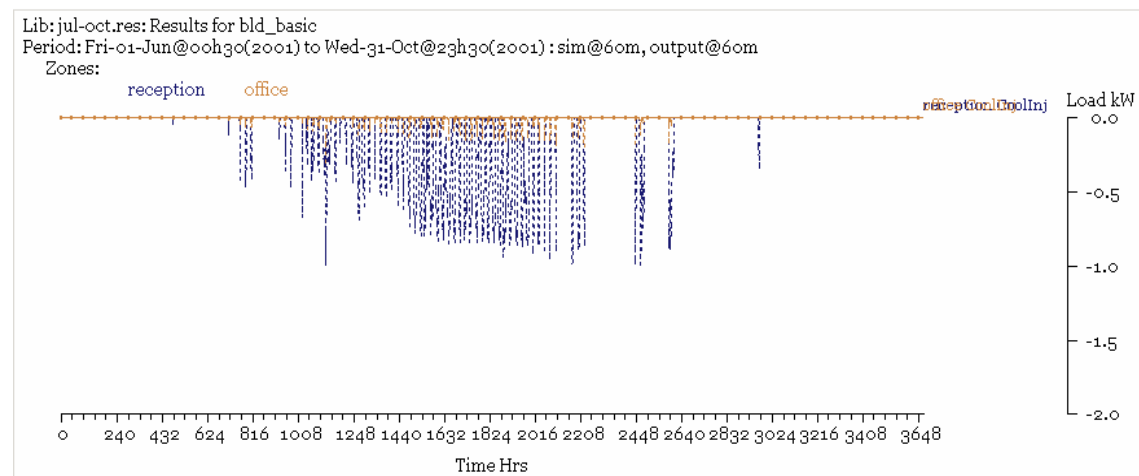
Lib: jul-oct.res: Results for bld_basic
Period: Fri-01-Jun@00h30(2001) to Wed-31-Oct@23h30(2001) : sim@60m, output@60m
Zones:



Graph 20: Cooling load after thermal mass exploitation of the wall structure & usage of natural ventilation

Scenario C: Use of shading (25% decrease in the size of the south-facing window) to reduce cooling load

MONTHLY GAINS & LOSSES	COOLING [kWh]			PASSIVE SOLAR GAINS [kWh]		
	Living room-kitchen	bed room	TOTAL	Living room-kitchen	bed room	TOTAL
JUNE	-0.4	-0.1	-0.5	306.5	163.0	469.5
JULY	-55.3	-4.2	-59.5	335.8	171.9	507.7
AUGUST	-250.6	-11.5	-262.1	390.1	157.0	547.1
SEPTEMBER	-30.0	-1.9	-31.9	395.0	122.6	517.6
OCTOBER	-1.5	0.0	-1.5	428.9	101.1	530.0
ANNUAL	-337.8	-17.7	-355.5	1856.3	715.6	2571.9



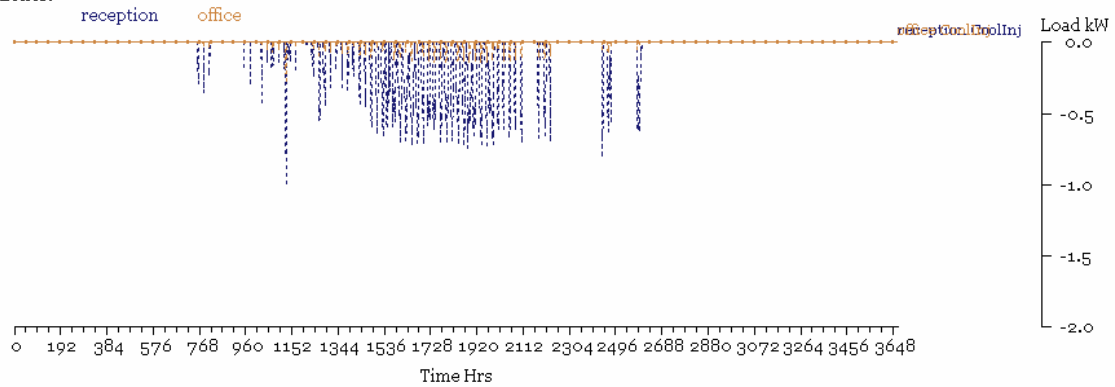
Scenario D: Use of shading (50% decrease in the size of the south-facing window) to reduce cooling load

MONTHLY GAINS & LOSSES	COOLING [kWh]			PASSIVE SOLAR GAINS [kWh]		
	Living room-kitchen	bed room	TOTAL	Living room-kitchen	bed room	TOTAL
JUNE	0.0	0.0	0.0	246.6	163.0	409.6
JULY	-24.4	-3.0	-27.4	269.9	171.9	441.8
AUGUST	-176.8	-9.3	-186.1	303.7	157.0	460.7
SEPTEMBER	-18.2	-0.8	-19.0	295.5	122.6	418.1
OCTOBER	0.0	0.0	0.0	312.6	101.1	413.7
ANNUAL	-219.4	-13.1	-232.5	1428.3	715.6	2143.9

Lib: jul-oct.res: Results for bld_basic

Period: Fri-01-Jun@00h30(2001) to Wed-31-Oct@23h30(2001) : sim@60m, output@60m

Zones:



Graph 22: Cooling load after thermal mass exploitation of the wall structure, usage of natural ventilation & 50% reduction in the south facing window

Simulation 6: Application of an earth to air heat-exchanger (after simulation 4)

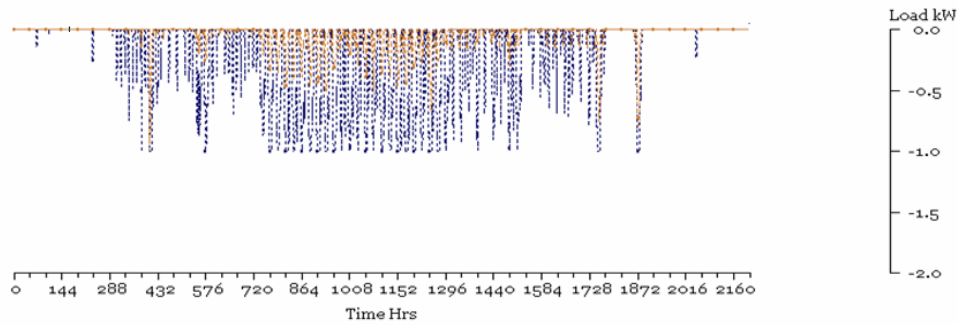
This is in addition to the previously applied natural ventilation and shading (simulation 4) in order to eliminate the cooling demand in Palermo.

HOURS	HEATING SETPOINT [°C]	COOLING SETPOINT [°C]
0 - 7	15	25
7 - 24	19	25

Scenario A: Ventilation from the pipes to the living room-kitchen from 10 am to 19pm

MONTHLY GAINS & LOSSES	COOLING [kWh]		
	Living room-kitchen	bed room	TOTAL
JULY	-65,7	-9,8	-75,5
AUGUST	-318,2	-75,4	-393,6
SEPTEMBER	-64,9	-16,5	-81,4
ANNUAL	-448,8	-101,7	-550,5

Lib: jul-sept.res: Results for bld_basic
 Period: Sun-01-Jul@00h30(2001) to Sun-30-Sep@23h30(2001) : sim@60m, output@60m
 Zones: **livingroom-kitchen** **bedroom**

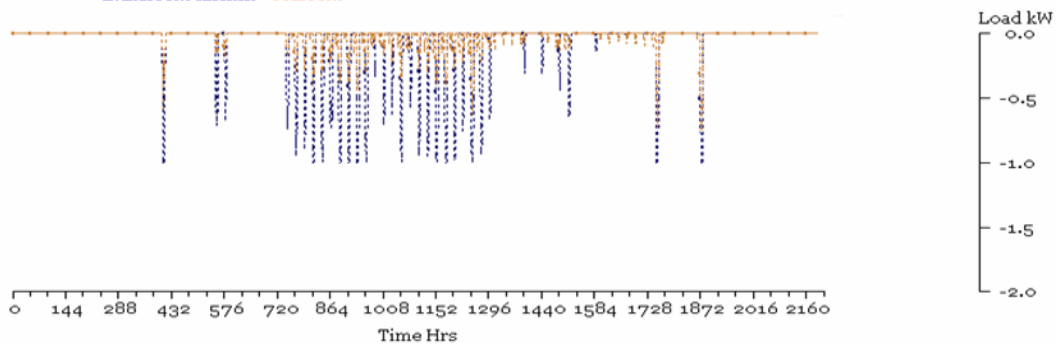


Graph 23: Cooling load after natural ventilation, 50% reduction in south facing window and ground heat exchanger working from 10am to 19pm

Scenario B: Ventilation from the pipes to the living room-kitchen from 6:00 to 24:00

MONTHLY GAINS & LOSSES	COOLING [kWh]		
	Living room-kitchen	bed room	TOTAL
JULY	-11,8	-3,6	-15,4
AUGUST	-106,8	-41,4	-148,2
SEPTEMBER	-16,8	-10,9	-27,7
ANNUAL	-135,4	-55,9	-191,3

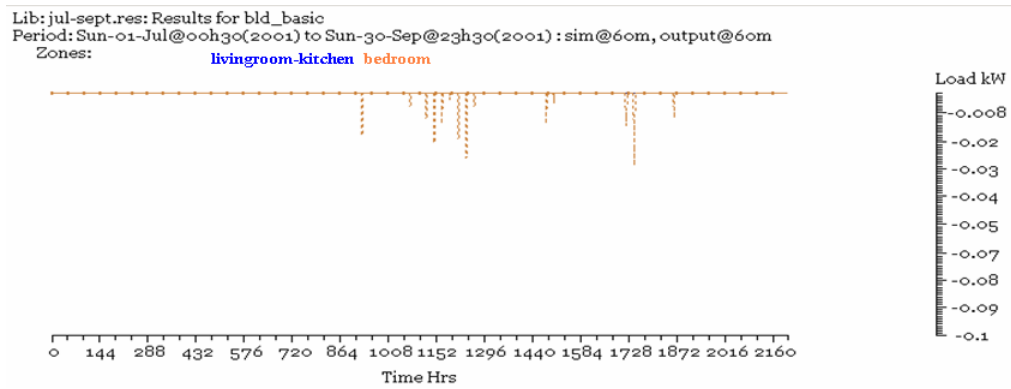
Lib: jul-sept.res: Results for bld_basic
 Period: Sun-01-Jul@00h30(2001) to Sun-30-Sep@23h30(2001) : sim@60m, output@60m
 Zones: **livingroom-kitchen** **bedroom**



Graph 24: Cooling load after natural ventilation, 50% reduction in south facing window and ground heat exchanger working from 10am to 19pm

Scenario C: Ventilation from the pipes to the living room-kitchen all day

MONTHLY GAINS & LOSSES	COOLING [kWh]		
	Living room-kitchen	bed room	TOTAL
JULY	0,0	0,0	0,0
AUGUST	0,0	-0,3	-0,3
SEPTEMBER	0,0	-0,2	-0,2
ANNUAL	0,0	-0,5	-0,5



Graph 25: Cooling load after natural ventilation, 50% reduction in south facing window and ground heat exchanger working from 10am to 19pm