



# STUDENT MODELLING COMPETITION

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Design and simulation of an energy-positive house

**Building Simulation 2013**

**Briefing Document**

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Version 1.1

# Presentation of the competition

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## Background

As part of the Building Simulation conference 2013 ([www.bs2013.fr](http://www.bs2013.fr)), IBPSA are running a student modeling competition. The aim is to facilitate wider participation in the conference and to provide a competitive forum for student members of the building simulation community. It is expected that several tutors of relevant courses in universities around the world will use this as part of their teaching material.

This document contains all the information relating to the competition. Entries will be judged *prior* to the conference with an award being made at the conference in Chambéry, FRANCE in August 2013.

## Tasks

For this edition of the competition, the aim of the exercise is to use computer simulation to design an energy efficient house.

The idea of the project is simple:

### We

Should provide you with a defined geometry, occupancy and lighting schedules, on-site measured weather data and minimum performances that you need to achieve

### You

Have to design the building in order to have an energy-positive house. However, you should pay attention to the simultaneous demand and production of on-site energy.

### You

Are free to choose the facades composition, the glazing surface on each façade, the solar shading devices, storage systems if any, and the heating, cooling and mechanical ventilation systems. You are also free to choose the simulation software to use as long as it is a validated code.

## Judging Criteria

- The key factors influencing the judges' decision will be *accurate* and *intelligent* use of building simulation.
- Secondary, but also very important, you will be judged on the integrated design of whole building concepts and on the energy performances of the house.
- The simultaneous demand and production of on-site energy.
- Comfort and indoor air quality criteria *must* be met.
- It is anticipated that two awards will be made: one for individual entrants and a second for group entrants.
- Please note that the decision of the judges is final and no negotiation will be entered into.

## Important Note

Winners will be notified on August 1<sup>st</sup> and will be expected to produce a poster for display at BS2013.

## Deliverables

One report containing the following sections:

- a) Title page (including author(s) name(s), affiliations, and contact details)
- b) Executive summary
- c) Contents
- d) Nomenclature
- e) Introduction
- f) Building Design
- g) Modelling methods employed
- h) Modelling Assumptions
- i) Results
- j) Conclusions
- k) References (if required)
- l) Appendices (if required)

Note: The deliverable should not exceed 15 pages long excluding the annex section.

## Key Dates

March 1 <sup>st</sup> 2013:	Entrants to notify the organizers of their intention to submit an entry using the “Statement of intent” page under the “student pages” section ( <a href="#">BS2013 website</a> ).
July 1 <sup>st</sup> 2013:	Deadline for completed entries.
August 1 <sup>st</sup> 2013:	Winners announced.
August 25 <sup>th</sup> – 30 <sup>th</sup> 2013:	BS2013 conference in Chambéry, FRANCE.

## Other Informations

### Heat gains

See Annex A / Heat Gains section.

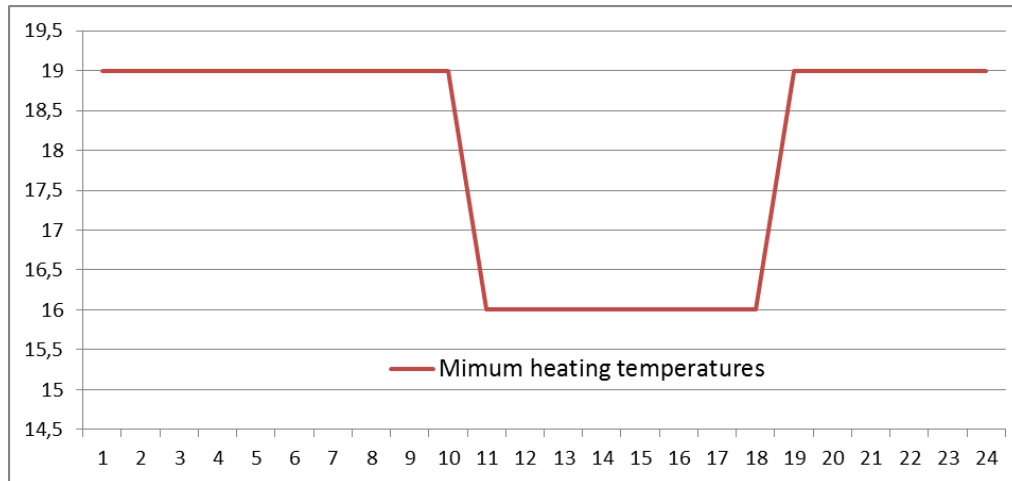
Note: Heat gains include lighting and all other “standard” appliances present in a single family house.

### Occupied period

The house is considered to be occupied all year long (we will not consider holidays). However there is a difference between weekdays and weekends (see appendix).

### Minimal required performance

- Minimum temperature during occupied heated period is 19°C. However, we authorize a reduction of the heating temperature to 16°C during unoccupied periods of the weekdays. Please refer to the following figure for the heating schedule.



- The operative temperature should not exceed 27°C for more than 50 hours throughout the year and 3 consecutive hours. At all times, the maximum operative temperature should not exceed 30°C.
- The minimal ventilation rate to ensure at all time is 0.6 ACH. If necessary during the summer period, this ventilation could be increased but the velocity inside the distribution ducts should not exceed 6m/s.

## Climate Data

Use weather data for **Chambéry**, France; provided at the conference web site under the “student pages” section.

## Queries

If you require any further information, please contact one of the following people. Please use email and try to make your question as concise as possible.

Louis Stephan (IBPSA-France), [louis.stephan@cea.fr](mailto:louis.stephan@cea.fr)

Timea Béjat (IBPSA-France), [timea.bejat@cea.fr](mailto:timea.bejat@cea.fr)

Malcolm Cook (IBPSA-England), [malcolm.cook@lboro.ac.uk](mailto:malcolm.cook@lboro.ac.uk)

All questions and responses will be posted to the competition section on the [BS2013 website](#) so please look here first to check that your query has not already been answered. Thank you.

# Appendix A

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## Floor plan:

Please look at the file “Floor\_plan\_Student\_Competition.pdf” for more details. The file is provided at the conference web site under the “student pages” section.

## Heat gains:

### For lighting and appliances

Gains for each bedroom (Watts)							
Hr	Mon	Tue	Wed	Thu	Fri	Sat	Sun
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	60	60	60	60	60	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0
23	60	60	60	60	0	0	60
24	0	0	0	0	60	60	0

Gains in bathroom (Watts)							
Hr	Mon	Tue	Wed	Thu	Fri	Sat	Sun
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	100	100	100	100	100	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	100	100
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	500	0	500	0	0	0	0
21	800	0	800	0	0	500	0
22	100	100	100	100	0	800	100
23	0	0	0	0	100	100	0
24	0	0	0	0	0	0	0

Gains for the kitchen (Watts)							
Hr	Mon	Tue	Wed	Thu	Fri	Sat	Sun
1	40	40	40	40	40	40	40
2	40	40	40	40	40	40	40
3	40	40	40	40	40	40	40
4	40	40	40	40	40	40	40
5	40	40	40	40	40	40	40
6	40	40	40	40	40	40	40
7	540	540	540	540	540	40	40
8	40	40	40	40	40	40	40
9	40	40	40	40	40	540	540
10	40	40	40	40	40	40	40
11	40	40	40	40	40	40	40
12	40	40	40	40	40	40	40
13	1040	1040	1040	1040	1040	40	40
14	40	40	40	40	40	1040	1040
15	40	40	40	40	40	40	40
16	40	40	40	40	40	40	40
17	40	40	40	40	40	40	40
18	40	40	40	40	40	40	40
19	40	40	40	40	40	40	40
20	1040	1040	1040	1040	40	40	1040
21	40	540	40	540	1060	1060	40
22	40	40	40	40	40	540	40
23	40	40	40	40	40	40	40
24	40	40	40	40	40	40	40

Gains for the living room (Watts)							
Hr	Mon	Tue	Wed	Thu	Fri	Sat	Sun
1	10	10	10	10	10	10	10
2	10	10	10	10	10	10	10
3	10	10	10	10	10	10	10
4	10	10	10	10	10	10	10
5	10	10	10	10	10	10	10
6	10	10	10	10	10	10	10
7	10	10	10	10	10	10	10
8	10	10	10	10	10	10	10
9	10	10	10	10	10	10	10
10	10	10	10	10	10	110	110
11	10	10	10	10	10	110	110
12	10	10	10	10	10	110	110
13	10	10	10	10	10	110	110
14	10	10	10	10	10	10	10
15	10	10	10	10	10	10	10
16	10	10	10	10	10	10	10
17	10	10	10	10	10	10	10
18	110	110	110	110	110	10	10
19	110	110	110	110	110	10	10
20	10	10	10	10	110	10	10
21	150	150	150	150	10	10	150
22	150	150	150	150	150	150	150
23	10	10	10	10	150	150	10
24	10	10	10	10	10	10	10

For people

Gains people bedroom1 (2 persons)							
Hr	Mon	Tue	Wed	Thu	Fri	Sat	Sun
1	160	160	160	160	160	160	160
2	160	160	160	160	160	160	160
3	160	160	160	160	160	160	160
4	160	160	160	160	160	160	160
5	160	160	160	160	160	160	160
6	160	160	160	160	160	160	160
7	0	0	0	0	0	160	160
8	0	0	0	0	0	160	160
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0
23	160	160	160	160	0	0	160
24	160	160	160	160	160	160	160

Gains people bedroom1 - bedroom2 (1 person)							
Hr	Mon	Tue	Wed	Thu	Fri	Sat	Sun
1	80	80	80	80	80	80	80
2	80	80	80	80	80	80	80
3	80	80	80	80	80	80	80
4	80	80	80	80	80	80	80
5	80	80	80	80	80	80	80
6	80	80	80	80	80	80	80
7	0	0	0	0	0	80	80
8	0	0	0	0	0	80	80
9	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0
23	80	80	80	80	0	0	80
24	80	80	80	80	80	80	80

Gains people Bathroom							
Hr	Mon	Tue	Wed	Thu	Fri	Sat	Sun
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	160	160	160	160	160	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	160	160
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0
22	160	160	160	160	0	0	160
23	0	0	0	0	160	160	0
24	0	0	0	0	0	0	0

Gains people kitchen							
Hr	Mon	Tue	Wed	Thu	Fri	Sat	Sun
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	360	360	360	360	360	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	360	360
10	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0
13	240	240	240	240	240	0	0
14	0	0	0	0	0	480	480
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0
20	480	480	480	480	0	0	480
21	0	0	0	0	480	480	0
22	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0

Gains people living room							
Hr	Mon	Tue	Wed	Thu	Fri	Sat	Sun
1	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0
10	0	0	0	0	0	240	240
11	0	0	0	0	0	240	240
12	0	0	0	0	0	240	240
13	0	0	0	0	0	240	240
14	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	240	240	240	240	240	0	0
19	480	480	480	480	480	0	0
20	0	0	0	0	480	0	0
21	480	480	480	480	0	0	480
22	360	360	360	360	480	480	360
23	0	0	0	0	360	360	0
24	0	0	0	0	0	0	0

