

# **Survey on solar shadings and electric lighting management systems : results and analysis**

**September 2004 – IEA 31 – Subtask A**

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This document analyzes the results of the survey on solar shading and electric lighting management systems, in office buildings.

The questionnaire placed in annex, has been submitted to 141 persons spread out in 54 office buildings in Belgium.

This survey was done between the 21<sup>st</sup> of January 2004 and the 30<sup>th</sup> of May 2004.

This document analyses the 133 questionnaires that were considered as valid.

## 1 General data's on solar shadings

The first section deals with the presence of solar shadings, their type, their position and their management.

### 1.a Presence of solar shadings

The answers at the first question "Is your office equipped with a solar shading ?" show that 19 % of rooms have no solar shadings. The occupants have thus no glare protection. This percentage is large but unfortunately, we know neither the orientation, nor the environment of the rooms which are not equipped with solar shadings. That prevents us from drawing a general conclusion about the presence of solar shadings.

	Yes	No	I do not know	Total
1. Is your office equipped with a solar shading ?	108	25	0	133
	81%	19%	0%	

Table 1: Answer to question 1.a

### 1.b Type of solar shadings

We asked here if solar shadings are of fabric type (like roller blinds) or with lamellas (like Venetian blinds).

We notice that there is about the same proportion of fabric blinds as venetian blinds.

The difference between the total number of buildings equipped with solar shadings (108) and the types of protections (125) shows us that 17 buildings are equipped with two solar shadings which differ by their position; often an internal protection coupled with an external protection.

	Fabric	Ven. blinds	Others	Total
1.b If yes, of which type?	63	59	3	125
	50.4%	47.2%	2.4%	

Table 2: Answers to question 1.b

### 1.c Position of solar shadings

When we consider the position of the solar shadings, we observe that the majority of them are placed inside the room. We observe nevertheless 36.8 % of external protections. Three percent of protections are placed between two glazings (in the case of ventilated double-skin façades).

	Inside	Outside	Between the 2	Total

			glazings	
1.c Where are they located?	75	46	4	125
	60%	36.8%	3.2%	

Table 3: Answers to question 1.c

#### 1.d Management mode of solar shadings

Only 13 % of solar shadings are managed automatically. We also notice that 4,6 % of the people do not know how their solar shading is managed. This value is very large because it shows that one person on 20 gives no attention to the solar shading which equips its window. Therefore, if this protection is not automatically managed, which constitute the majority of the cases, it is not managed at all.

	Yes	No	I do not know	Total
1.d Are the solar shadings automatically managed?	14	89	5	108
	13%	82.4%	4.6%	

Table 4: Answers to question 1.d

## 2 ***Automatically managed solar shadings***

The 14 persons working in a room fitted with automatic solar shadings answered the questions presented at this item 2. We asked them if they could override the automatic management system and at which frequency they benefit from this possibility. Then, we tried to see whether the automatic management was well tolerated and understood, in particular, according to the aspects of energy saving and of comfort.

#### 2.a Possibility to override the automatic system

Only 2/3 of the people can override the automatic management system. Notice that this possibility can not be applicable in case of high wind, due to mechanics protection of the external blind.

	Yes	No	I do not know	Total
2.a Do you have the possibility to override the automatic system	9	4	1	14
	64%	29%	7%	

Table 5: Answers to question 2.a

#### 2.b Use of this possibility

Within the people who can override the automatic system, 2/3 does it regularly. That means that 2/3 of people estimates that the automatic management system is not ideal.

	Yes	No	Total
2.b If yes, do you often benefit from this possibility?	6	3	9
	66.6%	33.3%	

Table 6: Answers to question 2.b

The reasons why the occupants override the management system are the following (we copied textually these answers):

- In order to have shading in the office,
- To avoid reflections on computer's screen (this reason comes 2 times),
- To avoid greenhouse effect,
- The system estimates that there is not enough sun to lower the blinds,
- The occupant estimates that he manages the solar shadings better than the automatic system.

Table 7: Reasons for which the occupants override the solar shading management system

It seems thus that there are systems which allow the penetration of direct solar radiation into the room.

The level of illuminance from which the system drops the blinds seems also to be too high for some people.

Moreover, the problem of daylight reflection on computer screens appears.

2.c Management system and disturbance

By analyzing the answer to the question 2c, one notices again that 2/3 of the population is disturbed by the solar shading management system. They are probably the persons who override regularly the system plus a part of the persons who do not have this possibility.

We notice one "don't know" person who does not know if automatic management of the solar shadings disturbs him.

	Yes	No	I do not know	Total
2.c Are you disturbed by the automatic management of solar shadings?	9	4	1	14
	64.3%	28.6%	7.1%	

Table 8: Answers to question 2.c

Why?

- When there is sun and wind, but it is to protect the material: to prevent that it does not tear with the wind.
- Management is not always adapted to the luminosity (ex: not sun but lowered protection, sun but raised protection...)
- It is inopportune

Table 9: Reasons why solar shading automatic management is disturbing

2.d Energy aspect

Question 2.d is related to the aspect of the building energy consumption. We asked the occupants if they think that their solar shadings were managed in order to reduce the building energy consumption. The answers show that either people do not know if the solar shading management limits the building energy consumption, either they think that it decreases this consumption. Nobody thinks that the management system has a negative impact on the energy consumptions of the building, which is positive in itself.

	Yes	No	I do not know	Total
2.d Do you think that solar shadings are managed so as to reduce the building energy consumption ?	9	0	5	14
	64.3%	0.00%	35.7%	

Table 10: Answers to question 2.d

Note: The remarks relate only to the solar gain limitations (and not about the electric lighting).

## 2.e Comfort aspect

The majority of the questioned people think that the solar shadings are managed so as to improve their comfort. Let us note nevertheless that more than 20 % of people do not know if the solar shadings management has a positive impact on their comfort. There is also one person who affirms the opposite.

	Yes	No	I do not know	Total
2.e Do you think that solar shadings are managed so as to improve your comfort ?	10	1	3	14
	71.4%	7.1%	21.4%	

Table 11: Answers to question 2.e

Why?

<ul style="list-style-type: none"> <li>○ I think that they are oriented to decrease the glare</li> <li>○ Yes, because there is limitation of the reflection on computer's screens</li> </ul>
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Table 12

When comfort is approached, concept of glare appears but people do not speak about overheating which was quoted in the point concerning consumption. It thus seems that occupants are not aware that the solar shading management must be commissioned according to the aspects of glare limitation and overheating. This point can be explained by two manners:

- Many offices have air conditioning systems (but we do not know the proportion of them within the framework of this study).
- The study was carried out during winter and spring, when there is no overheating problem.

## 2.f Global satisfaction

At the question: "Globally, are you satisfied by the solar shading management ?", only 42.9 % of the questioned people answers "Yes".

50 % of the people is only partly satisfied. This point shows that there is still much work to be realized compared to these management systems.

	Yes	No	Partly	Total
2.f Globally, are you satisfied by the solar shading management ?	6	1	7	14
	42.9%	7.1%	50.0%	

Table 13: Answers to question 2.f

One of the satisfied people specifies that her satisfaction comes from the fact that she uses the hand drive operation to manage and increase its comfort (heating/cooling and natural light).

The no satisfied person affirms that management is not always adapted to the luminosity.

The reasons of non-satisfaction are the following:

<ul style="list-style-type: none"> <li>○ Management system is not always adapted to the luminosity (3 persons)</li> <li>○ the system is disturbing (1 p)</li> <li>○ the system is not understood (1 p)</li> <li>○ The system is sometimes illogical (1 p)</li> </ul>
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Table 14: Reasons of non-satisfaction

### 3 **Manually managed solar shadings**

This paragraph deals with the manual management of solar shadings which are not managed by any automatic system. We approached here the frequency of the solar shadings modification of position and the aspects of comfort and energy savings.

#### 3.a Frequency of the position modification

We notice that more than 58 % of the occupants do not even modify the position of their solar shading 1 time per day. We can thus affirm with a quasi-certainty that these protections are very badly managed.

The proportion of the people who do not move their solar shadings more than one time per day is also very important (31,5 %). In this case, the management is certainly not optimal.

Lastly, approximately 10 % of the occupants modify the position of their solar shading between 2 to 4 times per day. In this case, we can imagine that management is adapted with the comfort of the user but we cannot affirm anything about the energy consumption.

	- of 1x/d	1x/d	2 to 4 x/d	+ of 4x/d	Total
3.a At which frequency do you modify the position of your solar shadings?	52	28	9	0	89
	58.4 %	31.5 %	10.1 %		

Table 15: Answers to question 3.a

#### 3.b Energy aspect

We asked here the occupants if they thought that they managed their solar shadings so as to limit their room consumption.

We notice here that there are more people who think to manage their solar shadings in a low-energy consumption way than people who modify the position of these protections more than one time per day.

There are thus people who say that they manage their solar shading in a low-energy way whereas they only modify their position once per day...

The knowledge of the occupants in term of solar shading management is thus very bad because we cannot imagine an interesting and intelligent solar shading management with only one movement a day.

	Yes	No	I do not know	Total
3.b Do you think that you are managing your solar shadings in order to limit your room consumption ?	13	64	12	89
	14.6 %	71.9 %	13.5 %	

Table 16: Answers to question 3.b

#### 3.c Comfort

We then asked the same question but related to the comfort. At the question "Do you think that you are managing your solar shadings in order to improve your personal comfort", 83 % of the questioned people answer "yes".

These answers, combined with the answers obtained at the question 3a, let us think that a majority of solar shadings remain in a low position (and closed for the Venetian blinds) during most of the time, and maybe always. The comfort management is simply carried out by closing solar shadings all the time and by compensating the lack of daylight by artificial light.

	Yes	No	I do not know	Total
3.c Do you think that you are managing your solar shadings in order to improve your comfort ?	74	12	3	89
	83.1 %	13.5 %	3.4 %	

Table 17: Answers to question 3.c

#### 4 **Artificial light: management linked to daylight**

The purpose of question 4 is to see in which proportions the artificial lighting systems are managed according to the daylight availabilities.

27 % of the questioned population say that their room is fitted with such systems. We think that this number is inaccurate (and overestimated) because some answers to the following questions show that questioned people make a confusion between the different types of systems installed in their office.

	Yes	No	I do not know	Total
4.a Is your room fitted with an artificial light system which is linked to the daylight availabilities.	36	97	0	133
	27.1 %	72.3 %		

Table 18: Answers to question 4.a

#### 5 **Artificial light linked to the daylight availabilities**

Only the people whose artificial light is linked to daylight availabilities answered to the questions 5. We study here their satisfaction to these systems, the possibilities and the frequencies of overriding.

##### 5.a Satisfaction

A majority of the population (58.3 %) is satisfied with this management system, 16.7 % are only partly satisfied, whereas 25 % of questioned population is not satisfied.

	Yes	No	Partly	Total
5.a Does the lighting management satisfy you?	21	9	6	36
	58.3 %	25.0 %	16.7 %	

Table 19: Answers to question 5.a

The reasons of partial satisfaction are the following:

1. Too much light
2. Light is too white
3. In a part of the room, the light is on, not in the other. Management creates disturbing contrasts
4. I am disturbed by the extinction of a lamp when there is nobody under the lamp

Table 20: Reasons of partial satisfaction compared to the lighting management system

Let us analyze in detail the remarks:

1. The management system is badly regulated or the lighting system is oversized (if it is not dimmable). We do not have additional information on the management system. It can be an on/off or a dimmable system. We can thus only have these two assumptions but we cannot find the exact reason of this complaint.

2. The second reason has nothing to do with the light management system. The light colour is an intrinsic characteristic of the light sources.
3. Here, we are probably in the case of an on/off system. Light that is switched on in a part of the room and switched off in the other (which is lighted in a natural way) can create high contrasts in the room. This one depends on the lighting and extinction thresholds, which is perhaps badly chosen.
4. The problem mentioned here has nothing to do with the management of the artificial light linked to daylighting. This is one disadvantage of the presence detection systems.

Reasons of non-satisfaction are as follows:

1. Too little light
2. Too much light
3. In a part of the room, the light is on, not in the other. Management creates disturbing contrasts

Table 21: Reasons of non-satisfaction compared to the lighting management system

Items 1 and 2 show a bad adjustment of the lighting threshold or a bad lighting system dimensioning.

The problem related to contrast is the same as in the case of partial satisfactions.

#### 5.b Possibility to override the management system

We then asked the occupants if they have possibility to override the automatic system.

We notice that only 50 % of the people can do it. There is also a small part of the people who do not know if they can override the system. It is a lack of information or, more probably, a lack of occupant interest compared to their environment.

	Yes	No	I do not know	Total
5.b Do you have the possibility to override the automatic system?	18	15	3	36
	50 %	41.7 %	8.3 %	

Table 22: Answers to question 5.b

#### 5.c Frequency of the use of this possibility

We also wanted to know how often the occupants benefit from this overriding possibility. The answers obtained to the question "Do you often override the automatic system" is enough scheming... Indeed, if we add the number of "yes" with the number of "sometimes", we obtain 24 persons who use this possibility. However, answers to question 5.b show us that only 18 persons (possibly  $18+3=21$  if one adds the persons who "do not know not") have the possibility to override.

There are thus more people who override the automatic system than people who have the possibility to do it.

	Yes	No	Sometimes	Total
5.c Do you often override the automatic system ?	15	12	9	36
	41.7 %	33.3 %	25	

Table 23: Answers to question 5.c

Let us examine in detail the crossed answers to questions 5.b and 5.c. The answers to question 5.b are to be read horizontally. The answers to the question 5.c are to be read vertically.

5c \ 5b	Yes	No	I do not know	Total
Yes	14	1	0	15
No	0	11	1	12
Sometimes	4	3	2	9
Total	18	15	3	

Incompatibilities between the answers of the two questions are located in the red cells. We thus observe that 1 person having answered "no" to the 5b question answered "yes" to the 5c question. This person affirms that he does not have the possibility to override the system but he does it nevertheless...

In the same way, 3 persons having answered "no" to 5b answer "sometimes" to 5c; they thus affirm that they do not have the possibility to override the system but that they do it nevertheless sometimes. We can thus logically wonder how these people manage to override the system, since they have just said that it is impossible...

In the same way, two people having answered "I do not know" to 5b (saying thus that they do not know if they can override the system) answer to 5c that they sometimes do override the system.

These incompatibilities show us clearly a bad comprehension of the questions or perhaps even of the systems.

We can now examine the answer to the question: "Why do you (not) use this possibility to override the system?"

- |  |
|--|
| <ol style="list-style-type: none"> <li>1. We do not like artificial light: we would prefer to have one switch. (no at 5c)</li> <li>2. In order to switch off the light at the end of the day. (yes at 5c)</li> </ol> |
|--|

Table 24: Reasons why people do (not) derogate from the system

Notice that the person making the first remark does not override the system because he does not have the possibility to do it.

#### 5.d Advantages of the artificial light management system

- |   |
|---|
| <p>5.d According to you, what is or what are the advantages provided by the light management system fitted in your room ?</p> <ol style="list-style-type: none"> <li>1. Energy savings during the night (1p)</li> <li>2. Energy savings (3p)</li> <li>3. None because the artificial light is ineffective (indirect system) (1p)</li> <li>4. None (2p)</li> <li>5. The commands are automatic (2p)</li> <li>6. The visual comfort is provided (1p)</li> </ol> |
|---|

Table 25: Advantages of the lighting management system installed in the room

Let us analyze in detail the answers:

1. The first person has not understood that we spoke about a management system linked to daylight because he speaks about energy saving during the night!!!
2. Only three people speak about energy saving.

3. Three people do not find any advantage to the management system. One of them argues by saying that the lighting system is not effective because it consists of indirect appliances. However, according to us, even if this system is not very effective, a management linked to the daylight availabilities can be interesting.
4. Two people speak about the interest of the automatics orders. We can thus assume that the system is effective in the case of these two people.
5. Only one person speaks about visual comfort.

## 6 **Manually managed artificial lighting**

Only people having answered "No" to question 4.a have answered question 6.

### 6.a Consumption limitation

We asked the occupants if they manage artificial lighting so as to limit consumption. Only 23 % answered "yes". The proportion of persons who answered negatively to this question is very important (66 %).

	Yes	No	Partly	Total
6.a Do you manage the artificial light of your room so as to limit its consumption?	24	69	12	105
	22.9 %	65.7 %	11.4 %	

Table 26: Answers to question 6.a

### 6.b Taking into account the daylighting

It is interesting to notice that 50 % of the persons estimate that they manage the artificial light according to daylight and that only 23 % of the participants say that they manage the artificial light in order to limit the consumption (question 6.a).

There is thus an incompatibility between the answers to questions 6.a and 6.b, unless that for the questioned persons, to manage the artificial light according to daylight only means to protect oneself from the glare.

	Yes	No	I do not know	Total
6.b Do you manage the artificial light according to the daylight ?	52	52	1	105
	49.5 %	49.5 %	1 %	

Table 27: Answers to question 6.b

### 6.c Frequency of the actions on artificial light

When we ask the occupants how much time per day they act on their lighting system, we notice that 50 % of these persons answer "less than 2 times per day". One can suppose that they are the persons who say that they do not take into account the daylight.

Only 15 % of the questioned persons act 4 times per day or more on the system.

	- 2 x p/day	2 x/day	4x/day	+ 4x/day	Total
6.c How many times per day do you act on the lighting system (switch on, dimming or switch off)?	54	35	14	2	105
	51.4 %	33.3 %	13.3 %	1.9 %	

Table 28: Answers to question 6.c

## 7 Visual comfort

### 7.a Is visual comfort reached?

Only 49 % of the questioned persons estimates that their visual comfort is reached. There is almost one quarter of the people that estimates that the visual comfort is not reached at all. This proportion is very important.

	Yes	No	Partly	Total
7.a Do you think that your visual comfort is reached?	65	31	37	133
	48.8 %	23.3 %	27.8 %	

Table 29: Answers to question 7.a

### 7.b Actions carried out in order to improve the visual comfort

Only 18 % of the people have done one or more actions to improve their visual comfort. This weak result shows the little reactivity of the occupants compared to a situation of discomfort. One can say that there is reaction only when discomfort is total.

	Yes	No	I do not know	Total
7.b Do you carried out a special action in order to reach the visual comfort ?	24	105	4	133
	18.0 %	78.9 %	3.0 %	

Table 30: Answers to question 7.b

We can analyze in detail the realized actions by 20 of the questioned persons:

1. Screen - filter on computer's screen (2 persons)
2. Positioning workstation according to the window (6p)
3. resourcefulness to avoid too much sun in the room (the blinds do not prevent glare) (1 p)
4. Addition of a desk lamp (3p)
5. Installation of a glazed door in the place of a full door. (1p)
6. White fluorescent lamps replacement by yellow fluorescent lamps (and reduction of the power) (1 p)
7. Addition of a halogen lamp with adjustable intensity for the dark days in winter (1p)
8. Addition of a luminary (1p)
9. I switch off the lamps located above me (1p)
10. I have stuck papers on the glazing to avoid glare (2p)
11. Installation of solar shadings (1p)

Table 31: Actions carried out by the questioned people in order to ensure their visual comfort

Several of these actions are related to a badly designed lighting system: items 4, 6, 7, 8 and 9. Item 1 limits the reflections on the computer's screen. However, we cannot say if these reflections came from artificial light or from daylight.

Item 2 is, according to us, the first action to realize in order to limit the glare problems for computer tasks.

In the case of item 3, solar shadings are unsuitable.

Item 5 is difficult to clarify. We are probably in the case of a room benefiting from borrowed light (secondary light from an adjacent space).

Items 10 and 11 show the absence or the bad choice of solar shadings.

### 7.c Action in order to improve comfort

For the question "Is it necessary to do some actions to improve your visual comfort ", only 25 % answer yes, whereas 52 % of people estimate that comfort is not completely reached (question 7a), which is rather paradoxical. These people thus think that their comfort is not reached but do not think that there are possibilities to reach it.

	Yes	No	I do not know	Total
7.c Is it necessary to plan an action in order to improve your visual comfort?	33	66	34	133
	24.8 %	49.6 %	25.6 %	

Table 32: Answers to question 7.c

Here is the list of the actions proposed by the persons answering "yes" to the 7c question.

<ol style="list-style-type: none"> <li>1. Placement of low transmission solar shading (1p)</li> <li>2. Renovation of the work environment (1p)</li> <li>3. To remove reflections on the computer's screens (3p)</li> <li>4. The use of blinds is often linked to the great solar gains due to the very large glazed surfaces of the offices (1p).</li> <li>5. To put more effective blinds, because when the sun is very low, the blinds are too bright (1p).</li> <li>6. Problem of luminosity too much variable from one hour to another and from one day to another (sun or overcast sky) (1p).</li> <li>7. When reading the questions, I think that there are possibilities to improve visual comfort (1p).</li> <li>8. To avoid the fluorescent lamps (1p).</li> <li>9. Screen - filter on computer's screen (2p).</li> <li>10. In summer: there is sometimes too much direct light that prevents from reading on computer's screen (bad orientation). In winter, ok with halogen (1p).</li> <li>11. Artificial lighting is sufficient (1 TL lamp 120cm /4m<sup>2</sup> in reflecting device) but the installation of "daylight" colour TL would be more pleasant (1p).</li> <li>12. To choose an effective lighting (enough light on work surfaces) and not only aesthetic lighting (1p).</li> <li>13. To repair the light switch (1p).</li> <li>14. To open hangings!!!! No daylight reaches the employees. The artificial light on the desks is insufficient to work on paper (1p).</li> <li>15. Lighting badly located (individual lighting). A personal desk lamp could be a solution (2p).</li> <li>16. To install a switch (1p).</li> <li>17. It is necessary to decrease the light level (1p).</li> <li>18. It is necessary to install solar shadings (2p).</li> <li>19. It is necessary to add TL lamps (2p).</li> <li>20. To leave the lighting level adjustable (migraine if too strong illumination) (1p).</li> <li>21. It would be necessary to place a coating on the desk which is too clear; there is not enough contrast between paper and office (1p).</li> <li>22. To increase window surfaces (more glazing -&gt; more daylight) (3p)</li> <li>23. To put the computer at good distance (1p).</li> </ol>
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Table 33: Actions to plan to improve the visual comfort

By analyzing the questionnaires, we notice that there are also people who answer that their visual comfort is assured but who propose nevertheless actions to improve it.

The actions to be realized relate to several broad topics. They are described here below (in the decreasing order from those who most frequently appears).

- o Generally, the lighting system has been badly conceived (window or artificial light system): items 4,8 (in this case, tubes are probably badly selected because the person

does not know that one can have a pleasant lighting with TL lamps), 11, 12, 14, 15, 17,19, 20, 22, 23 (15p)

- Problems of light reflection linked to a bad screen position, with the absence of solar shadings, or with an artificial lighting system badly conceived: items 3, 9, 10 (6p).
- No solar shading or unsuitable solar shadings : items 1,5, 6, 18 (5p)
- Management problems: items 13, 14, 16 (3p)

If we analyze accurately these points, we notice a well-known phenomenon: in an office occupied by several employees, people do not take the initiative to manage solar shadings: these remain thus closed all the time whereas discomfort appears because the artificial light system is under-designed.

The second point concerns the absence or the defect of a switch ... (and thus the impossibility either to override the system, either to manage manually the light, when there is no automatic system).

Items 2 (renovation of the work environment) and 7 (I think it is possible to improve comfort) are not precise enough to be classified. Item 21 (to chose a lighter colour for the desk) is rather confusing because the problem of contrast does not appear between the paper and the desk but between the paper and the writings or drawings on this paper ... we do not consider this item anymore.

We can conclude that few people really complain about problems of solar shading management or artificial lighting management. The first improvements should concern the design of lighting systems, the absence of solar shadings and the bad position of the computer's screens.

## **8 Conclusions**

### **8.a Solar shadings**

We can thus conclude that a great majority of office buildings are equipped with solar shadings. There is almost the same proportion of venetian blinds than rolling blinds. A large majority of protections are inside but more than one third is nevertheless outside. Only 14 % of solar shadings are automatically managed.

When solar shadings are automatically managed, two thirds of the people have the possibility to override the system. Only two thirds of those benefit regularly from this possibility. Among all the people whom solar shadings are automatically managed, two thirds think that this management is disturbing. Usually, people understand well that the blind management is carried out so as to improve their comfort. With regard to the limitations of consumption, the opinion is a little more divided. Globally, only 43 % of the questioned people are completely satisfied with the management system. Half of these people is only partly satisfied.

When we approach the manually managed solar shadings, we highlight the problem of information and reaction of the occupants; we observe that more than half of the persons do not even modify the position of their solar shadings 1 time per day. There are only 10 % of the people who modify this position 2 to 4 times per day whereas 15 % estimate to manage their protection in order to save energy consumption. When we analyze the aspect of comfort, we notice that 83 % of the people say that they manage their solar shadings in order to improve their visual comfort.

We cannot conclude it with certainty but we assume that solar shadings remain pulled down (and with fixed angle for the Venetian blinds lamellas) in the majority of the cases and that people estimate to reach visual comfort thanks to the artificial light.

However, when we approach the artificial light aspects, we notice that there is many complaints on this subject.

The study of solar shadings and their management learns us that:

- The manual management of solar shadings is far to be optimal,
- The automatic management of solar shadings is not satisfactory either.

### **8.b Artificial lighting**

We have some reserves about the answers to the questions on item 5 (artificial light linked to daylight availabilities) because it seems that, by lack of information, the occupants confuse the various lighting management systems.

We can thus conclude with certainty that there is a lack of knowledge on this point.

We notice also that 25 % of the questioned persons are not satisfied with the system. However, when we analyze the reasons of non-satisfaction, we notice that they relate rather to the lighting installation than to the management system itself.

The persons who cannot override the system complain about it. We also notice a comprehension problem about "what is overriding". This shows again an understanding problem of the lighting system.

Concerning the artificial lighting manual management, we also notice incompatibilities between the answers on the various questions: only 23 % of the people say to manage lighting so as to limit its consumption whereas 50 % say that they take into account the daylight. Moreover, 85 % of the occupants act maximum 2 times per day on the artificial light. In

Belgium, a country with variable climate, it is impossible to take into account daylight availabilities in that way.

The study of the artificial lighting and its management learns us that:

- The artificial light systems still present important gaps;
- The management systems are badly understood and still badly adapted but the satisfaction of the occupants is nevertheless better than that concerning the solar shading management;
- Manual management is ineffective.

#### 8.c Visual comfort

Half of the questioned persons affirm that their visual comfort is not achieved but only 25 % of the people think that they can solve this problem. The actions considered relate first to the artificial lighting installations themselves (lighting systems and solar shadings badly designed). Then come the problems of spatial organisation in rooms. Few people complain directly about management. That does not mean that the management systems does is not problematic but rather than the most important problems are linked to badly designed lighting systems and bad choices of solar shadings (or non-existent solar shadings).

#### 8.d General conclusion

In conclusion, we notice a poor knowledge of management systems installed and complaints when there is no possibility to override the automatic system.

We also notice a poor knowledge of what is a lighting system and many complaints relative to their design. At present, many technical solutions exist to design optimal and comfortable artificial lighting systems that do not generate glare problems anymore. It appears that these solutions are still not applied in many office buildings and that an important effort is still necessary. It is only in buildings with really effective lighting installations that we can study accurately the problems related to the lighting and to the solar shadings management systems.