Introducing sustainable summer comfort in the public sector

Elements for Codes of Conduct for public agencies when acting as tenants

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1 Introduction

Public agencies have a special role model function. They are in the position to communicate the importance of saving energy and resources, the advantages of energy efficient building and they can easily function as best practice examples. Public buildings often are visited of a lot of people and can thus influence and educate a lot of people.

In the last years the rising cooling demand is becoming a bigger topic not only in southern regions but also in middle and northern Europe. There are a variety of reasons. The architectural design tends to show large glass facades which are even and not “disturbed” by any shading systems”. Furthermore the number of electric appliances in offices is rising and so the internal heat loads are rising as well. Last but not least: our summers will be hotter, which makes it necessary to use measures to keep the heat out of a building.

Landlords tend to build buildings as cheap as possible. This strategy leads to high running costs which the tenant has to pay. So usually there is little financial incentive for landlords to invest more money to ensure lower running costs.

Therefore a strategy was developed to make it more attractive for landlords to build energy efficient buildings or to invest in energy efficiency measures.

This guideline offers recommendations for public agencies as tenants on how to minimise costs for sustainable summer comfort. These recommendations reach from planning together with the landlord over possible measures and energy management strategies as well as possibilities to share savings with the landlord, to special requirements to the landlord for the premises to rent and contractual appointments.

2 The strategy

Building users can influence both the performance of the building by their own behaviour (by adjusting the set-points for indoor temperatures, opening or closing windows, etc.) and the decisions of the building owner through rental agreements. Tenants with an environmental policy must be educated to ask for the service "summer comfort" and not just for a cooled building.

Landlords tend to keep the investment costs of a building as low as possible. They don't care about running cost which burden the budget of a tenant. Therefore a investment sharing model was developed to make it more attractive to the landlord to undertake energy saving measures.

2.1 Participation in the planning phase of the building

To keep running costs low, especially the costs for securing summer comfort and you, as a user, have the opportunity to participate in the planning phase of the building the following steps should be followed:

1. Define the thermal comfort objectives explicitly
2. Intervene on the site layout and features of the surroundings of the building which can affect summer comfort
3. Control and reduce heat gains at the external surface of the building envelope
4. Control and modulate heat transfer through the building envelope
5. Reduce internal gains
6. Allow for local and individual adaptation
7. Use passive means to remove energy from the building
8. Use active solar assisted cooling plants
9. If still necessary to reach the stated comfort objectives, use high efficiency conventional active cooling plants
10. Train the staff on how to use, monitor performances and adequately operate and maintain the building.

For detailed information on each of the steps, the toolkit of KeepCool was developed. On http://www.ceeeta.pt/keepcool/ all details are available.

The additional investment costs (if they arise) could be paid by the landlord at the beginning. During the using time of the building the tenant can pay the costs back by sharing the savings with the landlord. Details about this model you can read in chapter 2.4.

2.2 Participation in the planning phase is not possible

An adequate combination of local and individual adaptation factors with regards to local climate and buildings such as flexible clothing, furniture, air movement and activity would foster personal natural comfort (both psychological and physical) while reducing energy consumption within the context of sustainable cooling. These pos-

sibilities allow for the use of passive cooling in a greater variety of climates; on the other hand, they allow setting maximum temperatures higher in mechanically cooled buildings.

First you should check if the building meets the criteria defined in the ten steps. If it does, temperatures are likely to stay below the maximum indoor temperature of 26 °C or you only have a small deviation.

Most of the time measures to ensure sustainable summer comfort – like sun shading systems, natural ventilation concepts, changing of thermal mass etc. – is no problem to realise and landlords are likely to realise these measures – but they would not pay the costs. Hence a strategy to involve the landlord in savings is helpful to realise energy efficiency measures. Details of this strategy are described in chapter 2.4.

If the tenant wants to ensure summer comfort without or with limited use of electric energy, there are a lot of effective measures which can be undertaken (see chapter 2.3).

2.3 Saving measures to be undertaken

2.3.1 Sun shading systems

To make sustainable summer comfort possible, sun shading systems are essential. It is important not to let the heat of the sun enter the room. Are there shading systems on the inside of the window, the heat already entered the room and only a small share of the heat can be reflected to the outside. Therefore shading systems on the outside of the window have to be preferred.

As it is important for people to have the view to the outside and to have enough daylight, there is a big variety of shading systems available on the market. The available products reach from specially reflecting blinds and perforated blinds to light directing blinds and different colours and materials of the blinds.

Ideally, the blinds are controlled automatically and day light depending. If users are instructed very well, they can replace this automatic control quite well when considering some easy advices. The most important advice is to close the blinds early enough. The air temperature isn't very high in the morning but the heat radiation of the sun already heats up the room.

If the sun doesn't shine, the blinds shouldn't be closed to let as much light in as possible. Otherwise electric energy is needed for artificial lightning.

There can also be a control system which is equipped with an air velocity sensor which roll in the shading system when there is a strong wind.

2.3.2 Windows

2.3.2.1 Ventilation during the day

Is the outside temperature exceeding the indoor temperature, windows have to stay closed. Wind on evaporates the humidity of the human skin an thus produces thus cools the body and produces the feeling, that the outside air temperature is lower the inside air temperature. Therefore it is also very important, that special attention is paid to the temperatures or windows have to be close at e.g. 09:30 in the morning.

2.3.2.2 Night ventilation

If possible, windows can be opened during night to use the natural ventilation to cool the thermal mass down to be able to save the heat during the day. Sensors which induce to close the windows automatically if it rains can be installed.

2.3.3 Office equipment (computers, printers, lighting etc.)

Electrical equipment is a major heat source in office buildings. Inefficient advices convert a lot of the electricity needed into heat losses. Efficient computers and screens need approx. % less electricity than (old) inefficient ones and emit less heat. When tenants purchase new equipment, it is important to consider the efficiency of the advices in order not only to save energy for the electric devices but also to save energy for cooling.

Furthermore, energy for the equipment and for cooling can be saved, if the electric devices are turned off, when they are not used (e.g. in absence of the user because of a meeting).

The tenant should also think about minimising the number of electric appliances. Maybe one printer for a few offices is enough and not everybody needs an own printer in his office, etc.

2.3.4 Lighting system

Filament bulbs convert approx. 90 % of the electricity they need into heat and are thus very inefficient and should no longer be applied. There are a lot of efficient lamps available on the market. They need less energy and moreover, they emit less heat. Reflecting lamp shades make the system more efficient additionally.

In addition to the efficient lamps presence and motion sensors can be used to turn on the light only when it is really needed.

2.3.5 Furniture

Special chairs transfer the heat of the body to the surrounding area and do not “insolate”, so the body doesn’t heat up that much.

2.3.6 Activity

A slightly different measure as we are used to is the following:

If your business allows, change typical “9 to 5” office hours to a so called intensive or continuous shift or working day which goes from e.g. 8 a.m. to 3 p.m. with a short break (20-30 min.) for lunch. Thus the time people are working during hot hours is minimized.
For people at risk consider “heat wave holidays” during high temperature periods.
In hot regions or during hot seasons, “siesta” could be introduced.

2.3.7 Air movement

Through air movements the humidity on the skin is taken up by the air and cools the body through this evaporation. But higher air velocities produced by fans needs electricity and can cause headache, hardening, etc and should therefore be avoided.

2.3.8 Air conditioning system

If there is an air conditioning system installed, make sure that it is an efficient one and that it is only turned on, when it is really needed (define maximum indoor temperatures). Make sure that it is turned off, when you leave the room for meetings or at the end of the day or on weekends.

2.3.9 Energy management

If users are informed very well about the function of the building and the technical equipment and how to operate it, a large energy saving potential can be realised. Nevertheless automatic control systems can bring additional savings and rising in comfort.

2.3.9.1 Sun shading systems

Opening and closing of blinds can be done automatically. A light sensor meters the amount and direction of radiation and sends an impulse to a controller which directs the blinds to the right angle. The advantage is that the blinds are always adjusted to the actual light situation. That means, that there is always enough daylight available at the working spaces and the heat stays outside the room.

A wind sensor can induce rolling in of the blinds. If this works automatically, the user also doesn’t have to care about his/herself about rolling in the blinds.

2.3.9.2 Windows

Users tend to open the windows even when the outside temperature is exceeding the indoor temperature. As mentioned in chapter 2.3.2 the evaporation makes the user feel cooler but the actual cooling load rises because of the heat gain. Therefore sensors can measure the indoor and outdoor temperature. Is the indoor temperature exceeding the outdoor temperature, windows can be automatically opened. If the

indoor temperature is lower than the outdoor temperature, the windows will be/stay closed. Thus it is avoided, that warm air from outside gets inside.

Furthermore a rain sensor or a wind sensor can induce that windows are closed.

2.3.9.3 Office equipment

Office equipment can automatically be switched off at a certain time or if a computer hasn't been used for e.g. 30 minutes.

2.3.9.4 Lighting system

Presence and motion sensors make sure, that the light is only turned on when it is needed. Additionally daylight sensors can control and vary the illumination in the room according to the existing luminance.

2.3.9.5 Air conditioning system

All passive measures should have priority to the air conditioning system. If passive measures work (shading system is sufficient, windows are opened, etc.), the air conditioning system should automatically be switched off. Is the indoor temperature exceeding a defined value, the air conditioning system can automatically switched on – e.g. only if windows are closed.

2.3.10 Information for users

Even if a building would be energy efficient, the user has a big influence on the actual energy consumption. Users of a building must be informed about the building and its equipment to be able to operate it efficiently. They must be continually aware of the importance of the part they play in energy management. Therefore they have to be informed very well. The potential to save energy, exact descriptions of the building, unambiguous work instructions and supplementary training are vital to the success of energy management. To successfully implement energy management it needs a little bit more. Users have to be motivated to save energy and they should be motivated to develop ideas and methods to improve the energy consumption. To support motivation a company policy states the importance of the topic for the board.

A brochure, posters and regular trainings continually inform users and conjure up the importance of saving energy.

2.3.10.1 Plan-do-check-act

To improve the energy consumption the user must know his consumption data, analyse the data and then plan and undertake further measures. First of all a monitoring system should be installed to log the consumption. There are a lot of different ways to show information: e.g. on a hourly, daily or monthly basis, etc. By analysing these consumption data big consumption loads, "wrong" behaviour of users and reciprocal obstruction of different technical appliances can be identified. Afterwards measures should be developed and undertaken to counteract these gratuitous

consumption. After undertaking the measures the consumption again has to be monitored and actions have to be developed and undertaken.

2.4 Incentives for the landlord to save energy

Basically most of the landlords build a building as cheap as possible and they do not care about running costs which have to be paid by their tenants. A landlord is likely to realise a lot of energy efficiency measures if the tenant will pay them. If an incentive can be offered the landlord will be more likely to bear a share of the investment costs. In the following chapter an example of sharing investment costs, which then is an incentive for landlords, will be described.

2.4.1 Energy performance contracting

The concept “Contracting” can be used as a method to create incentives for landlords.

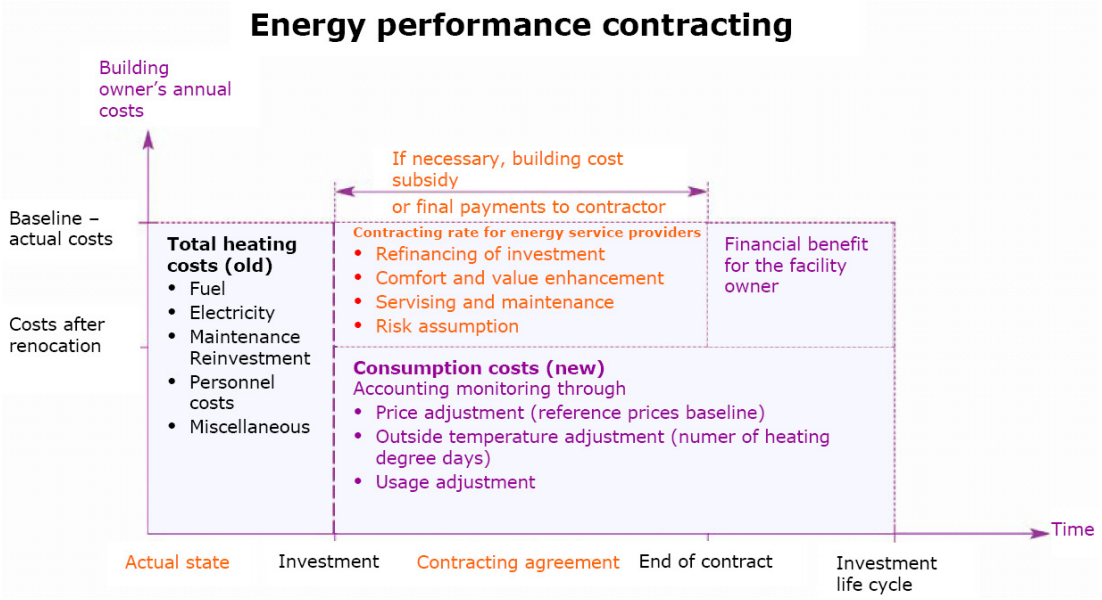

Figure 1: Statement of costs for energy performance contracting[1]

If a project is undertaken with contracting, the contractor pays the investment costs of the efficiency measures (or a share of it). After implementing the measures the actual energy costs are lower than before. The User of the building pays his old costs. The difference between the old and the new energy costs is used to pay the investment costs back to the contractor. After the contract duration (e.g. 5 - 10 years or longer depending on the measures) the user of the building fully profits from the energy savings. In the “real” form of contracting, the contractor accounts for the planning, financing and installation/execution of the required structural and technical

[1] Austrian Energy Agency, Energy Agency Grad; Integrating Energy Management in comprehensive Facility Management Service tenders, 2007

measures over the contract period and he guarantees a certain amount of energy saving.

2.4.2 "Contracting" with the landlord

As landlords don't have the necessary know-how to be a contractor, elements of the model "Contracting" are taken and are suitable to be used.

The modernisation of the building can be done on the landlord's or the tenant's own initiative. To develop a modernisation concept an energy consultant or planners can be assigned. They will estimate energy savings. The investment costs of the undertaken saving measures can either be fully bearded by the landlord or the tenant and the landlord share the costs. Basically the tenant pays the energy costs of the old building for some time and the difference between the old energy costs and the lower new costs receives the landlord as a pay back of the investment costs. Depending on the share on the investment costs the pay pack payment can be higher or lower or the duration of this model varies.

To work out a modernisation concept, the following steps have to be followed:

1. Target setting
2. Potential analysis
3. Calculation of energy cost baseline
4. Calculation of energy savings amount
5. Defining the rights and obligations of the landlord and the tenant

2.4.2.1 Target setting

First of all target should be set to concretise ideas and goals. These targets can be e.g. a certain amount of energy cost reduction, improvement of user comfort, ecology of building materials, CO_2-savings, image etc.

2.4.2.2 Potential analysis

If there is and energy saving potential and how much potential there is has to be analysed in this step. The energy performance certificate tells you the energetic quality of the building. With this certificate weaknesses can be found in a first step. In a second step a site visit gives an exacter picture of the building. An energy consultant or a planner then works out measures to improve the energy efficiency of the building.

2.4.2.3 Calculation of energy savings amount

When calculating the energy savings amount within the normal contracting model, the energy consumption of the last year is taken into consideration. In this case the tenant stays the same.

In case of a new tenant, it would be possible to consider the energy consumption of the last year of the former tenant. The problem is, that the former tenant could have had a completely different behaviour then the new tenant. So the consumptions could not be comparable. Therefore it is advisable to calculate the baseline according to the demand. A rough energy consumption of the electric equipment should be added to the demand (power of the equipment multiplied by the estimated running hours).

If major changes to the use of the building are made during the contract duration, the baseline (heat, electricity, water, …) has to be adjusted. Major changes in use would be: extension of usage time, shutdown of parts of the building or system etc.

By multiplying the estimated energy costs by the energy price, the anticipated energy costs are calculated. The energy consultant or planner will have made an estimation of the energy savings amount – e.g. 40 %. Depending on the amount of investment costs which the landlord will have to bear and the planned contract duration, the extent to which the landlord will get a share of the savings has to defined (e.g. 80 % of the 40 % savings). If rates shall be lower, the contract duration will have a longer duration. If the complete savings are transferred to the landlord, the contract duration can be shortened.

The difference to the “real” contracting is, that the landlord is not in the position to guarantee the quality of the workmanship or energy savings.

2.4.2.4 Defining the rights and obligations of the landlord and the tenant

The agreements made have to be fixed in the contract:

- Investment costs bearded by the landlord and the tenant
- Share of the energy savings for the landlord
- Pay back time
- Client of the measures
- Method of payment, penalties
- Procedure when savings shouldn’t be sufficient for the clearance payment
- Procedure when the usage of the building changes intensively
- Procedure when the tenant moves out of the building before the pay back period is running down or the tenant terminates the contract before a specific time; e. g. the landlord can either claim the rest of the investment costs or confer the contract on a new tenant
- Etc.

To ensure the accuracy and validity of a contract, a legal practitioner should be assigned.

3 Summary

Building users can influence both the performance of the building by their own behaviour (by adjusting the set-points for indoor temperatures, opening or closing windows, etc.) and the decisions of the building owner through rental agreements. Tenants with an environmental policy must be educated to ask for the service “summer comfort” and not just for a cooled building.

To give advice on summer comfort, measures are described to be undertaken by the tenant and the landlord including:

- Sun shading system
- Windows
- Office equipment
- Lighting system
- Furniture
- Activity
- Air conditioning system
- Energy management

Buildings which are rented have relative low investment cost but very high running costs. The reason for that is that landlords tend to keep the investment costs as low as possible and do not care about running costs which the tender has to pay.

There are only a few landlords who offer high quality buildings with low running costs for their tenants. The majority doesn’t find that important because there is no direct fiscal incentive.

Therefore a strategy was developed and is described in this guideline to make energy efficient building more attractive for the landlord: The landlord bears the investment costs (or a share of it) and gets these costs paid back from the tenant by a share of the resulting energy savings. Different models are possible: The tenant could contribute to the investment costs. Thus the contract duration could be shorter or the yearly payback rate could be lower.

Or: If the contract duration should be lower the yearly rates have to be higher; and vice versa.

The following agreements have to be fixed in the contract:

- Investment costs bearded by the landlord and the tenant
- Share of the energy savings for the landlord

- Pay back time
- Client of the measures
- Method of payment, penalties
- Procedure when savings shouldn’t be sufficient for the clearance payment
- Procedure when the usage of the building changes intensively
- Procedure when the tenant moves out of the building before the pay back period is running down or the tenant terminates the contract before a specific time; e. g. the landlord can either claim the rest of the investment costs or confer the contract on a new tenant
- Etc.

The realised solution will always be a mixture of the mentioned measures and the contract agreements will also always differ from case to case. To ensure suitable measures an energy consultant or planners should be assigned and a legal practitioner should set up a valid contract.