ENERGY MANAGEMENT IN HOSPITALS

Management of the actions

The optimization actions must be :

- known
- justified and proposed
- carried out
- submitted to an efficiency control.

being known:
This is certainly the most important task. Chapter 6 gives useful suggestions for possible actions.
being justified and proposed :
The justification is mainly based on the reduction of energy costs. Therefore, one must in the first place define the interest rate for the necessary capital investment ("In the banks, there is also an interest rate"), the residual value of the equipment concerned (if an improvement of the equipment is involved) as well as the duration and the type of the depreciation (for instance linear).

being carried out :
The execution procedure depends largely on the action and its scale. It must be defined for each case separately. For huge projects the energy manager will only be involved as the initiator and the person responsible for the quality.

being submitted to an efficiency control :
The efficiency control can only be carried out together with all the other actions taken during the year because in general there is a lack of accurate measures.

The energy manager must manage all these actions. Therefore it's useful to make a list concerning the management of these actions including the following columns :

- place of the equipment
- present state, problems
- proposed actions
- estimation of the energy savings (kwh, m3)
- cost of the actions
- residual value of the elements of the improved equipment
- interest rate of the invested sum
- duration of the depreciation
- calculated period of amortization
- planned realizations
- proposition to … on…
- decision taken by …. on…
- final date of the realization

Actions

ENERGY COSTS = ENERGY REFERENCES*ENERGY RATE =
(ENERGY CONSUMPTION + ENERGY LOSSES - ENERGY PRODUCTION)*ENERGY RATE
(in order to make things simpler, the energy performance is identical).

If we only consider the financial aspect of the energy management, it's possible to work on

* the energy consumption
* the energy losses

The effect of those two factors has been partially "wiped out" by the rise of the energy costs during recent years. It is thus also necessary to take into consideration :
the factor internal energy production
the energy rates

A classification of the (potential) actions has been made up as well as, from time to time, a time table of the periods in which the actions must be carried out ideally.

Potential savings: in the following charts, the number of crosses (+) indicates the potential savings resulting from an action when the expenditures/receipts are taken into consideration.

Periods and terms : A difference is made between the actions which could be carried out on short (S), medium long (M) and long (L) term.
The actions mentioned hereafter are subordinate to the present configuration, in other words not all actions are possible or judicious for all types of equipment and for all types of buildings.

1. Energy Rate

ENERGY COSTS =
(ENERGY CONSUMPTION + ENERGY LOSSES - ENERGY PRODUCTION) * ENERGY RATE

1.1. Electricity

Since the liberalization of the electricity market for high consumers (> 100 MWH/a) on 1.1.2009, nearly all hospitals may choose freely where they will get their energy. However, this only concerns the actual energy as the transportation of the energy through the electricity grid is consigned to the network manager (distribution network and regional grid). As one has no influence on the taxes either, only a small part of the energy costs may be submitted to a request for quotation.

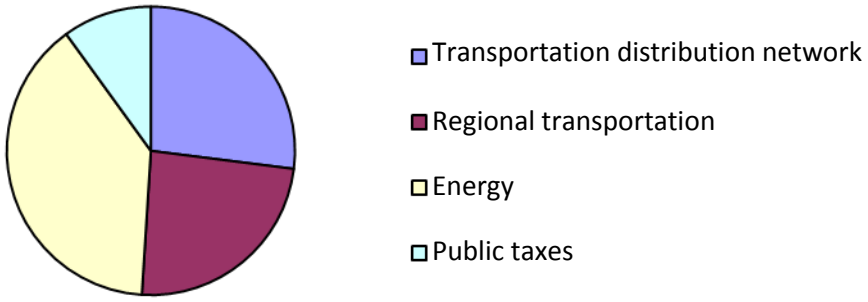


diagram : example of a partition of the costs as to the supply of electric energy

For the calculation of the costs for the transportation of electricity , the distributors must calculate the costs on the basis of predefined rules. All consumers (subscribers) can, according to the characteristics of their consumption (mostly on the basis of their overall consumption but sometimes also on the basis of the efficiency) benefit from fixed group rates. Within the range of this group rate, all consumers must have the same rate, in other words, special discounts aren't possible.

The consumers who stay with their local energy supplier have momentarily the "advantage" that they are protected against an increase of the prices for a couple of years. The rates of the customers remaining loyal to their supplier must remain at their minimum when it comes to the costs of the supply and the market costs. All price-rises must be justified towards the authorities (ElCom).

Every high consumer theoretically has the possibility to leave his present supplier (local electricity company) (only with regard to the part energy, see above). However, he has to take into account that he won't be able to return to the local energy supplier and thus profit from the "frozen rates". The following principle is being applied: "Once entered into the free market, forever in the free market".

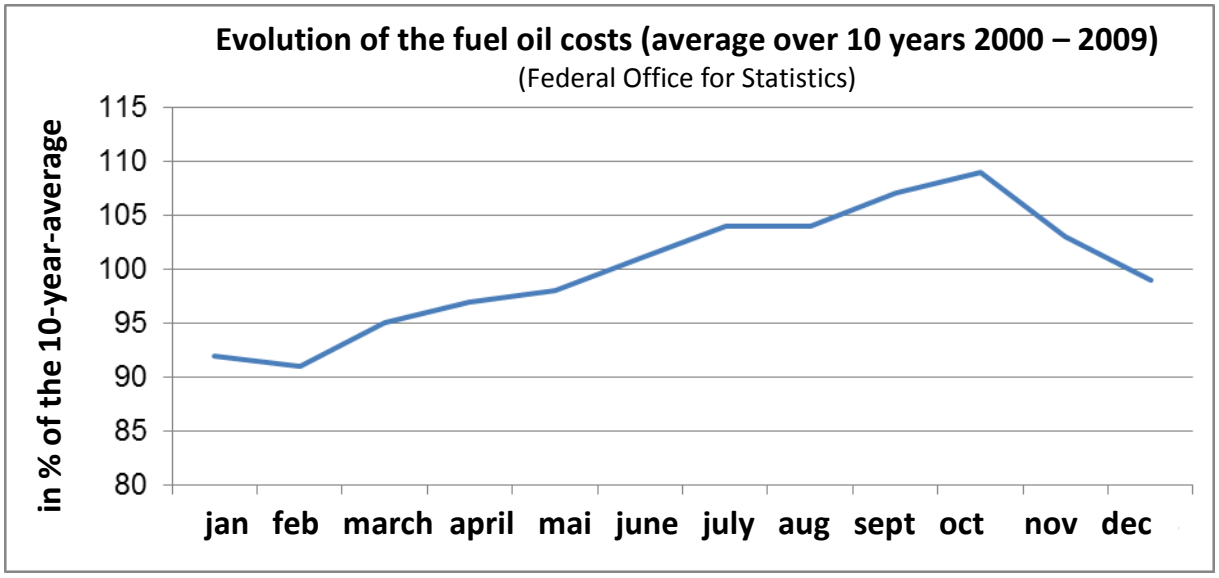
The participation into the free market during the first years of the liberalization should therefore be taken into account based on this fact.

The following elements should be verified when the new rates are applied, regardless of the fact that a hospital takes part in the free market or remains loyal to the local energy supplier :

Keyword	Explanations - details	Potential
partition in profitable group rates	Depending on the supplier and the energy consumption, we may come to borderline cases for certain categories of consumers	x
separation of high consumers by the distributor	By separating the high consumers the supplier can grant another group rate (possibly also a new one)	x
change of the energy product	Financial or ecological optimization. Renewable energy, internal (domestic) → environment, image Foreign energy, not renewable → financial advantage	xx
Use of additional services	Regardless of the rate or the group rate there is a possibility to negotiate "free" additional services such as an evaluation of the energy, online access to meter data, hiring of measuring instruments, etc..	x
Change of the low-voltage grid to the medium-voltage grid (subscription to the NE5 grid)	This can be beneficial when there are large costs for the entire low-voltage grid and lower costs for the medium-voltage grid. Normally there is no right to change the level of the grid. When negotiating a change of supplier or distributor, this can be used as "means of exchange".	xx
Influence on the price-fixing of the group rate	In the special cases when a hospital is a huge consumer for an energy supplier (for instance 10 %) it may be interesting to negotiate when the price-fixing takes place. The type of price-fixing for group rates is not strictly determined legally (rates for low-voltage, medium-voltage, …). As bargaining is always to the disadvantage of other consumers, this type of action is questionable, to say the least.	x
Price cuts on the other services provided by the energy supplier	If the supplier provides other services as well (water, gas, telecommunication, …) there is at least a possibility to ask for discounts on the non-liberalized products. On principle, this policy is also legally questionable.	xx

1.2. Fuel Oil

The optimization of the costs for fuel oil is limited to the choice of the date and the request for quotation towards the suppliers. When having made an optimal purchase during the last 10 years one could have saved, only by choosing the right date, 20 % of the costs compared to the worst case scenario.



Diagram

Evolution of the fuel oil costs (average over 10 years 2000-2009)
(Federal Office for Statistics)

1.3. Natural Gas

For the supply of natural gas, there is in fact a monopoly. Hence, there are clearly defined limits as to the optimization. Possible improvements are to be found in relation with other products (see the foregoing paragraphs) from the multi-utility providers.
Furthermore, the price-setting must be negotiated with the supplier when the contracts for the heat supply or the kitchen installations are to be renewed.

1.4. Drinking-water

For the supply of drinking-water, there is in fact a monopoly. Hence there are clearly defined limits as to the optimization. Possible improvements are to be found in connection with other products (see the foregoing paragraphs) from the multi-utility providers.

1.5. District Heating (teleheating) or heat production by the contractor

If all the heating is supplied on the basis of an existing contract by a district heating supplier or by a contracting party, competitive offers are in principle excluded. Replacing this system by an internal heat production system is generally not an alternative. Only the installation of solar panels or the heat recuperation on cold production for a part of the heat production may be taken into consideration.

To improve the situation, only the following alternatives might be available:

- Collecting of rates based on benchmarking (other producing companies / customers). Negotiations with the supplier (distributor).
- Discussion of the basic data in relation to the amortization period and the interest.
- Installation of a solar heating system for the production of hot water (replacement).
- Installation of an electric heating system for the production of hot water (replacement).
- Installation of heat recuperating system on the cold production installation (replacement).

2. Energy production

ENERGY COSTS =
(ENERGY CONSUMPTION + ENERGY LOSSES - ENERGY PRODUCTION) * ENERGY RATE

Based on the present legislation (2009, KEV), it may make sense for the hospitals to produce their own electric power (see chapter energy production) or to hire out free roofs to the local energy suppliers (distributors) or to specialized firms.

The possible energy production systems for the building are normally reduced to :

- heat/power coupling (heating station, in the future: combustion cell). This is a system for converting energy. However, these systems are not yet quite perfect. These systems only become cost-effective if there's a large difference between the part electricity and the part fuel oil/gas (for instance 2:1) and up till now this ratio is lower (1,5 : 1);

- use of a solar heating system (solar panels). Considering the already considerable and still rising energy costs, such a system should be analysed with regard to the suitable roofs available for energy management;

- use of photovoltaic panels. Considering the considerable energy costs and the considerable grants (KEV) and the constantly increasing importance of the eco-power market, the energy manager should make an analysis of the available suitable roofs. Sometimes it's useful to collaborate with specialized firms and the electricity suppliers.

3. ENERGY CONSUMPTION (incl. losses)

ENERGY COSTS =
(ENERGY CONSUMPTION + ENERGY LOSSES - ENERGY PRODUCTION) * ENERGY RATE

S short term
M medium term
L long term

3.1. Heating

Actions, installation/system	Tasks and duties	Potential	Term
Management of the installation Control of the settings/adjustment/ tuning of the system	Are the tasks to be carried out known and clear ? (training!) Does the description of the tasks always meet the needs ? Does the working of the installation always correspond to the description of its functions ? Avoid fluctuations in the settings.	xxx	S
Improvement of the efficiency of the boilers	With the boilers operating in two cycles, the thermostat has to be tuned in a way that the boiler works as long as possible in the lowest cycle.	xxx	S
	If possible reduce the tuning settings of the installation (you must however be aware of the risks of condensation as to the minimum entry temperature)	xxxx	S
	Whenever possible, in addition to the setting of the boiler, try to set the temperature of the boiler glidingly according to the needs	xxx	S
	Carry out overhauls on a regular base, a.o. when the temperature of the exhaust gasses is rising (regular checks). The temperature of the exhaust gasses may not exceed 120°C + the working temperature of the boiler. The performance (efficiency) of the boiler decreases with 1 % in order to remedy an increase with 20° of the temperature of the gasses.	xxx	S
	When using a condensation boiler you must pay attention to the maximum entry temperature regarding the use of the condensation heat.	xxx	S
	Try to keep the surrounding temperature of the boiler room as high as possible (for instance 30°), try not to cool down through the regular ventilation (ventilation system of opening of windows) but also be aware that there is enough combustion air.	x	S
	Check the tightness of the valves; in summer you may switch off a boiler manually and close the valves manually.	x	S
	Try to reduce the boilers in operation	xx	S
heat pumps	When used for the heating system and hot sanitary water, try if possible to work with variable regulations and cycles (summer/winter , ECS). Increase the COP.	xxx	S
	When using heat pumps air/water you have to check the air inlets (for filth, the filters, etc…)	xx	S
	Check the unfreezing system and modify if necessary	xx	S
	Set the limit heating temperature (ECO) of the heating unit	xx	S

heating units	as low as possible (for instance: day 18°C - night 5 to 8 °C)		
	Check the delta T forth & back (for instance tuned at 20K). When the delta T is lower (10 K for a setting of 20 K), reduce the capacity of the pump.	xx	S
	Try to lower the heating curves as much as possible, particularly in combination with ventilation with heat recuperation.	xx	S
	For well-insulated buildings and during the night, try to establish periods when the heating unit is completely switched off (e.g. 1 o'clock till 3 o'clock).	x	S
	Only replace the pumps by pumps of efficiency class A	xxx	M
	Keep the floor heating as low as possible (< 30°C) in rooms with much sunlight in order to profit as much as possible from the solar energy.	xx	S
	Check the pressure tuning of the variable pumps and adjust if necessary	x	S
	Install thermostatic valves on radiators.	xxxx	S
Installation and management of thermostatic valves	Set the thermostatic valves at about 20° C (pos. 3). Try to avoid the air circulation removing the heat from the room.	xxxx	S
	When there are other air cooling systems in operation (air circulation units, 'coolceilings', variable air evacuation), make sure that the range of the settings of the thermostatic valves and the cooling settings are sufficient (min 3 K) to avoid a mutual influence (heating and cooling at the same time).	xxx	S
Improve the output of the solar collectors	Clean the collectors (panels) and make them clear of snow. Try to avoid surrounding trees Adjust the working temperature to the consumer (as much as possible).	xx	S
Improve the insulation	Insulate the boilers (and the burners).	x	S
	Insulate the valves.	x	S
...	...	...	...

3.2. Cooling

Actions, installation/system	Tasks and duties	Poten-tial	Term
Management of the installation Control of the settings/adjustment/ tuning of the system	Are the tasks to be carried out known and clear ? (training!) Does the description of the tasks always meet the needs ? Does the working of the installation always correspond to description of its functions ? Avoid fluctuations in the settings.	xxx	S
Verify the performance coefficient of the cooling machines	Measure the COP if the corresponding energy measurements are available. If there is a decline (under the same circumstances) you have to request an overhaul from the manufacturer of the cooling machine	xxx	S
Optimization of the COP with regard to the behaviour of the cooling machine	Analyze the evolution of the degree of efficiency of the cooling machine (partial charge/full charge) and adapt the settings of the cooling machine	xxx	S
Optimization of the COP with regard to the condensation temperature	Reduce as much as possible the temperature of the condensation cycle: • determine the minimum temperature (based on the technical documentation of the manufacturer - sometimes there are different temperatures for the upstart and for a long-term use!); • introduce the corresponding settings for the condenser; • if the values for the upstart and for the long use are different, introduce higher temporary values for the upstart. This way lower values for the long-term use are possible; • set the values for the condenser as low as possible.	xxx	S
Optimization of the COP with regard to the evaporation temperature	Increase the temperature of the evaporation cycle as much as possible: • determine the necessary minimum temperature of the consumer (dehumidification, difference summer/winter) • introduce the corresponding settings for the cooling machines and the evaporation • if possible, introduce different settings for summer/winter.	xxx	S
Optimization of the TFA with regard to the behaviour of the cooling machine	Avoid too much start/stop cycles	x	S
Optimization of the condenser	Determine the performance coefficient of the condenser on the basis of the different outside temperatures. Make a follow-up of the evaluation data of the performance coefficient, in other words introduce different setting values for each condenser depending on the outside temperatures (outside temperature = temperature of the air, don't use the	xx	S

	external temperature gauge if it's attached to an outside wall!)		
Condenser	Increase the performance coefficient by removing the dirt from the condenser	xx	S

Actions, installation/system	Tasks and duties	Poten-tial	Term
Condenser with sequential access	• Test the sequence • Firstly, make maximum use of the surfaces of the condensers • Use the condensers in parallel before raising the speed of the ventilators • As to the cooling towers: sprinkle them before using the fans	xxx	S
Ice accumulator	Test the performance coefficient (lower vaporisation, but lower condensation temperature during the night as well; at reduced rate) and question the functions. E.g. avoid charging the ice accumulator during the weekends when the energy rates are lower.	xx	S
...	• ...	...	...
Freecooling	• Determine the minimum temperature necessary for the consumer (transition period/winter!) • Set a temperature limit for switching to Freecooling. • Check the efficiency coefficient.	xxx	S
Heat recuperation	Test the performance coefficient of the heat recuperation. In case the cooling machine is working very effective, one must re-evaluate the heat recuperation according to the following criteria: • Financial saving • Ecology • Image • No use of the boiler in summer (which leads to an increase in life span) • Prone to malfunction • Competition with other systems (solar panels, freecooling) Possible decrease in use of the heat recuperation during summer (preheating SWH (solar water heating), post-heating in case of dehumidification).	xxx	S
Reduction of the energy consumption of the cooling machine pumps	• Test the possibility of reducing the number of turns of the condenser and evaporator pumps (frequency changer) for partial functioning. • Adjust the corresponding behaviour.	xx	M
Reduction of the energy consumption of the distribution pumps	Test the settings with different pressure values of the network pumps. The distribution valves must be fully opened in normal circumstances	x	S
Reduction of the capacity	• Check and increase the Delta T on the consumer network (min 6 K) • Consumers should work with variable capacities	x	S

	• Close the by-passes		
Reduction of the minimum number of turns of the frequency changer	Question de minimum settings of the frequency changer and try to diminish anyhow. Per 10 Hz, the internal cooling must be sufficient in most cases.	x	S
Reduction of the heating of the cooling basin (open or hybrid cooling)	Don't set the heating of the reservoir too high If possible, empty the basins as soon as possible	x	S
Improve the performance coefficient of the cold ceilings	Test an overnight cooling	xx	S
Cooling of the premises	Introduce the summer compensation in all non-technical rooms (settings depending on the outside temperatures. Maximum difference of temperature compared to the outside temperature = 6K.	xxx	S
	Consistent use of outside solar protection (automation, instructions and information to the users)	xxx	S
	Avoid opening windows in the summer (instructions and information to the users, if possible automatic switching off of the cooling system when the windows are open)	xxx	S
	Control of the computer room. Server on 28° or at least 26 °C. Also check the placing of the computer equipment and avoid hotspots.	xxx	S
	Temperature of the UPS rooms (inverters) at 30°C or at least 28°C.	xxx	S

Actions, installation/system	Tasks and duties	Poten-tial	Term
Reduction of the working time of the installation	Reduction of the working time	xxxx	S
	Stimulate 1st speed (higher efficiency coefficient)	xxxx	S
	Separate the working times of the communal installations	xxx	S
	Test the use of presence detectors (e.g. in the operating theatres)	xxx	M
	Install CO detectors in the garages	xxx	M
	Working time of the ventilation in the lavatories in connection with the light switches	xxx	M
	Introduction of an intermittent functioning system (lavatories, battery room)	xxx	S
	Installation of operating devices (illuminated push buttom) on site to avoid a possible maximum use (meeting rooms, auditorium, etc..)	xxx	M
Management of the installation/ control of the settings	• Are the tasks to be carried out known and clear ? (training!) • Does the description of the tasks always meet the needs ? • Does the working of the installation always correspond to description of its functions ? • Avoid heating and cooling at the same time (also interference between radiators and ventilation)	xxxx	S

	• Sequence of heat recuperation/heating/ cooling OK ? • Avoid fluctuations in the settings		

3.3. Ventilation

Actions, installation/system	Tasks and duties	Poten-tial	Term
Adjustment of the quantity of air if necessary	Check the needs concerning the air quantity (based on the needs of a non-smoker)		
	Adjust the air quantity by means of a reduction of the number of revolutions (frequency changer, speed), reduction of the pressure settings or reduction by means of the air supply regulator	xxxx	S
	Adjust the air quantity by changing the pulleys	xxx	S
	Adjust the air quantity by installing a frequency changer	xxx	M
	Increase the difference in temperature between the hot and extracted air in the cooling installations	xx	S
	Installation of air quality meters	xxx	M
Optimization of the dehumidification	Question the need of a dehumidification system		
	Eliminate dehumidification	xxxx	S
	If it's not immediately possible, raise the settings of the dehumidification	xxx	S
Optimization of the humidification	Question the need of a humidification system. Take the hygienic problems into account		
	Eliminate humidification	xxx	S
	Avoid humidification outside the winter season by a manual stop/voidance or a yearly program	xx	S
	If it's not immediately possible, lower the settings of the humidification	xx	S
Optimization of the two-canal installation	Increase the cold settings so that there's no need of mechanical cold supply in the winter	xxx	S
	Increase the cold settings so that there's no need of mechanical heat supply in the summer	xxx	S
	Idea of reconversion to a one-canal system	xx	L
	Verify the tightness of the mixers	xx	S
Improvement of the efficiency coefficient of the fans	Change the trapezoid fan belt by flat or crenated belts	xx	M
	Use high-efficiency fans		
	Use motors with a better performance coefficient	xx	L
Reduction of the minimum number of revs of the frequency changer	Question the minimum settings of the frequency changer and lower them anyway. At 10 Hz, the internal cooling must be sufficient in most cases.	x	S
Diminish the obstacles hampering the discharge	Replace dirty filters (loss of pressure)	x	S
	Avoid filters that are too thin and replace if necessary	x	S
	Clean the protection grids	x	S
	Install larger canals (new buildings)	x	L

Optimization of the goals of the installation	If possible don't use the ventilation for heating or cooling purposes	xxx	L
	Verify the performance coefficients and the nightly cooling functions	xx	S
Use of free energy	Verify the need and the possibilities of automatic cleaning	x	S
	Consider the installation of heat recuperation systems	xxxx	L
	Fully increase the percentage of air circulation (if available)	xx	S
	Verify the efficiency coefficient of heat recuperation		
	Install a thermal automation (to let the sun blinds down depending on the heat)	xx	S
Air cooling machine	Installation of thermostats for an automatic stop when a fixed temperature is exceeded	xxx	S
	Verify the temperature of the ice water. When it is <13°C the cold energy generally turns mostly into condensation instead of in the lowering of the room temperature.	xx	S

3.4. Sanitary equipment

Actions, installation/system	Tasks and duties	Poten-tial	Term
Use of the installation Control of the settings	• Are the tasks to be carried out known and clear ? (training!) • Does the description of the tasks always meet the needs ? • Does the working of the installation always corresponds to description of its functions ? • Avoid fluctuations in the settings.	xxx	S
Strategy concerning the charging of the boiler	Look out for the best heat production system (financially, ecological ?) for the bivalent provision of hot sanitary water. During the summer, it's often possible to charge the boiler with electricity when the prices of gas and fuel oil are high. The energetic coefficient for charging the boiler by means of SWH (outlet gasses, loss of steam, distant pipes, etc...) is often low compared to a system with electric resistors placed in the boiler.	xx	S
Circulation, complementary heating	Stop the circulation during the night during a certain period of time (for instance 22.00 hrs till 06.00 hrs for the offices)	xx	S
	Adjust your circulation to the needs (switching-on based on the return temperature)	xx	S
	Reduce the flow in the circulation pipes	xx	S
	Hold the settings low for the heater ribbons (generally lower than the outlet of the boiler)	xx	S
Reducing of the reservoir losses	In major SWH installations with many reservoirs, reduce the actual volume of the reservoir and maybe put one reservoir out of use		

Actions, installation/system	Tasks and duties	Poten-tial	Term
Reduction of the drinking water consumption (partially also the SWH consumption)	Use of economic water pipes	xxx	S
	Removal of the air renewal appliance with cooling by means of drinking water	xxx	S
	Sensitization of the users	xxx	S
	Reduction of the water pressure	xxx	S
	Verify the drinking water use in the kitchen. If necessary take measures (behaviour of the users, appliances)	xx	S
	Use flow limiting devices	xx	S
	Install toilets with 2 amounts of rinse water	xx	M
Reduction of the use of hot water	Set the water taps with only one handle always on the cold position for short uses (especially the taps which are far away from the circulation points)	x	S
	Use only hot water when it is necessary, for instance not in the technical rooms. This also reduces the risk of legionnaires' disease in these rooms (but pay attention to the next circulation point). Put the corresponding circulation pipes out of use.	xx	M
	Don't simply try to eliminate the risk of legionella infection by increasing the water temperature	xx	S
Sprinkling and watering	Install water sensors and check them	xx	S
	Choose plants that hardly need watering	xxx	M
	Choose an economic watering system (for instance a drop by drop system)		
anti-freeze heating	Check if the heater ribbons are protected against the frost (pipes, drains). Consult the instructions.	xx	S
Reduction of the water pressure	Put the settings on the minimum. Therefore, find the "worst consumer".	xxx	S
	Reduction starts with large hysteresis	x	S
...	Reduction starts using an air chamber (air receiver)	...	...
Placing of fountains	Switch over to the circulation system	xxx	M
	Introduce time programs	xx	S
Osmotic water	Only use this when absolutely necessary	xx	M

3.5. Electricity - Appliances

Actions, installation/system	Tasks and duties	Poten-tial	Term
Management of the installation Control of the settings	Are the tasks to be carried out known and clear ? (training!) Does the description of the tasks always corresponds to the needs ?		

	Does the working of the installation always correspond to description of its functions ?	xx	S
photocopiers, printers, PC	Activate the standby functions. Set the activation periods as low as possible	xx	S
	Switch these appliances off at the end of the working day	xx	S
All appliances	Reduce the standby losses by switching the appliances off at the end of the working hours	xx	S
	Install intelligent switches, for instance for the television sets in the patient rooms or the coffee or beverage vending machines	x	S
	Use low-energy appliances when the appliances have to be replaced (LCD, refrigerators with an A-label, etc...	xxx	M
time switches	Look for summer/winter system. When such a system doesn't exist, it is easy to install it and in the same time to introduce energetic optimization	xx	S
Illumination of advertising board	Switch off at night	x	S
exterior lighting	Switch off at night where possible	x	S
Lighting of the rooms	Light switched on or off dependent on daylight	xxx	M
	Light turned on or off by a signal from presence detectors	xxx	M
	Dimmer based on daylight	xxx	M
	Decrease of the light intensity , especially in circulation zones. When there are two bulbs, remove one of them.	xxx	S
	Use illumination equipment with ballasts with small losses	xxx	M
	Use interior decoration with light colours	xxx	M
Optimization of the electric power	Introduce a system with regulation of the power performance in order to eliminate power peaks	xx	M
Elevators	Optimize the light in the lift cages (extinguish when not used)	x	M
	Optimal design (calculation) of the counterweights	x	M
	Reduction of the friction of the pulleys by greasing or replacing them (technical maintenance service of the elevators)	x	S

3.6. Construction

Actions, installation/system	Tasks and duties	Poten-tial	Term
Windows	Replace/improve the grooves	xx	M
Doors	Change/improve the thickness	xx	M
Front doors	Optimization of the door openings	x	M
Envelope of the building	Reduce and eliminate the influences of the chimney	xx	L
Ventilation openings	Try to reduce the ventilation openings (lift cage, stokeholds) as much as possible	xx	S
...	...	...	...

3.7. Users

Actions, installation/system	Tasks and duties	Poten-tial	Term
Influence on the behaviour of the users	Organize actions (booths), make flyers and spread information (internal and external newspapers) regarding the theme	xxx	S
	Spread flyers	x	S
	Organize training for the co-workers according to a top-down system (1 chief trains 6 subordinates)	xx	S
	Make night tours and inform the discovered shortcomings directly to the users (lights stayed on, ...)	xxx	S
Use of the knowledge and know-how of the users	Install a suggestion box, organize contests with prices	xxx	S
Increase the sensitization	"Do good and tell it" : internal and external newspapers, reports, etc..	xx	S
Encouragement of long-term results	Energy saving should be a long-term and not a transitory issue	xxx	S

3.8. Processes : medical techniques, dish-washing

Actions, installation/system	Tasks and duties	Poten-tial	Term
Steam	Critical evaluation of a central steam production. Normally a central steam production requires far more energy than a decentralized production in the appliances (lack of maintenance, use on the basis of the worst consumer, loss of heat, etc..)	xxx	M
	Define the worst consumer and regulate the pressure correspondently	xxx	S
	Take the temporal need of pressure into consideration, in other words, use a lower pressure during the nights	xxx	S
	Check the temperature of the flue gasses. The temperature must be between 70 and 110°C higher than the temperature of the boiler. With an increase of the temperature of 20 K, the performance coefficient of the boiler diminishes with one percent. Do regular overhauls (calcification, ...)	xxx	S
Dish-washers	Replace the existing dish-washers by low-energy models	xxx	L
	Start and stop when the machines must be used. Often they are automatically switched on when the staff comes in.	xx	S
Medical techniques	Take the energy aspect into consideration when replacing the apparatuses	xxx	L
Cooling cells	Verify the need of cells, you may consider to replace them by small freezers.	xx	S
Compressed air	Lower the settings as much as possible. Do this based on the worst consumer	xxx	S
	Verify the cooling function of the compressor	x	S
	Eliminate the network losses. A steep rise of the starts causes an increase in the loss of air (define the working hours). Another indication is the duration of the working during the nightly hours.	xx	S
	Try to reduce the number of starts by installing an air buffer	xx	S

4. Sources

[1] Energiemanagement in Spitälern, Energie2000, Ausgabe 1995
[2] Grundlagen für die Betriebsoptimierung von komplexen Anlagen. Energie Schweiz, 2002 siehe www.bfe.admin.ch/energie/00567/00571/?dossier_id=00736&lang=de
[3] Abschlussbericht, Analyse des Energieverbrauchs und exemplarische Best-practice-Lösungen für relevante Verbrauchssektoren in Krankenhäusern, Fraunhofer Umsicht, 2009. http://www.umsicht.fraunhofer.de/publikationen/studien/EnEff_KH_Az_23472_Abschlussbericht_Download.pdf

5. Links

Organisations
- energo www.energo.ch
- ElCom www.elcom.admin.ch
- AES – Association des entreprises électriques suisses www.strom.ch
- OFEN – Office fédéral de l'énergie www.bfe.admin.ch
- Swiss Energy Council www.worldenergy.ch
- Intelligent Energy Europe ec.europa.eu/energy/intelligent/index_en.html

Energy theme
- Stromproduktion und -anwendungen (en allemand) www.strom-online.ch
- energienuclaire www.kernenergie.ch
- PowerON www.poweron.chindex.html)

Renewable energy
- AEE – Agency for renewable energy and the energy efficiency www.aee.ch
- GSP – Professional Swiss group for heating pumps www.pac.ch
- SSES – Swiss company for solar energy www.sses.ch
- Swissolar www.swissolar.ch
- Suisseenergie, programme Small hydraulic plants www.smallhydro.ch
- Suisse Eole www.wind-energie.ch
- Biogas www.biogas.ch

Energy saving
- Energybox www.energybox.ch
- Topten www.topten.ch
- SAFE Swiss agency for energy efficiency www.energieeffizienz.ch
- eae – Energy agency electrical appliances www.energybrain.ch/