Operational optimisation measures for companies

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Set thermostat valves correctly before the heating season

If the room temperature is too low or too high in only a few rooms at the start of the heating season, this will be due in most cases to individual thermostat valves that are either faulty or incorrectly adjusted.

Action

At the start of the heating season – usually in October – check whether all the thermostat valves are working, and that the right temperature is set.

Requirement

Radiators or underfloor heating are controlled by thermostat valves.

In buildings, every additional degree C increases the heating costs by 6 to 10 per cent.

What to do

Release and adjust a jammed valve:

1. Remove the thermostat head

- Relieve pressure on the thermostat: to do this, turn it to the highest level; this reduces the pressure on the valve pin.
- Remove the thermostat head (depending on the model: slacken the screw, or turn the clamping ring counterclockwise).

2. Release the valve pin

- If necessary, pre-treat the valve pin with penetrating oil solvent spray.
- Gently tap the pin with a rubber mallet until it can be moved (see overleaf). Caution: do not pull the pin out! If you can push the pin in with your finger and it then comes out again automatically, the valve is working again.

3. Fit and adjust the thermostat head

- Fit the thermostat head back in position.
- Set the temperature you want. When doing this, keep to the guidance values (see overleaf) for the relevant type of room usage.

Costs – effort

- Your own labour for one room with three thermostat valves: ¼ to 1 hour
- New thermostat head: approx. CHF 50
- Valve and thermostat head: approx. CHF 100
- If there is no way to disconnect the radiator from the water system, the entire heating system must be drained and refilled so you can install the new valves. In this case, it is best to replace all the valves in the building at the same time.

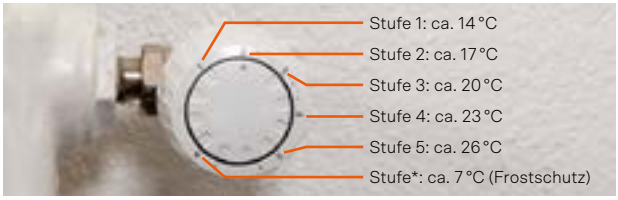
Please note!

Make sure that the same temperature is set on all thermostat valves in the same room. (Mechanical) thermostat valves from different manufacturers basically have the same structure. However, they differ as regards design (fixing, setting options) and scaling (temperatures). All manufacturers' websites offer good, easily understandable instructions on operating their products.

Additional explanations

Temperature setting

You will see that the thermostat valves are only marked with numbers or bars, but no specific information is stated about the temperature settings. The scaling may differ slightly from one manufacturer to the next, but the principle is similar for all these devices. Here are some guidance values to show approximately which temperature is set in which position:



The “right” room temperature

The following temperatures are valid as guidelines for a pleasant indoor climate:

- Office, meeting room: 20 to 22 °C
- Workshop: 18 °C
- Warehouse, basement: 16 °C
- Areas where people circulate: 17 °C
- WC, showers: 20 to 23 °C

Ensure air circulation and prevent heat accumulations

As far as possible, do not cover or obstruct radiators, thermostat valves and perforated radiator covers with furniture, documents (including books, files, folders) or vases, etc., because this can cause heat to accumulate. Warm air must be able to circulate freely from the radiator into the room. The thermostat valve must not be located in an area where heat accumulates: otherwise, the measured temperature will be too high. If this is not possible, you must use a model with a remote sensor. The sensor is placed on the wall so it measures the effective room temperature.

Blocked valve pin

Example of a blocked valve pin (see the arrow) that can be released by gently tapping it with a rubber mallet. Under no circumstances should you pull the pin out manually.

Programmable thermostat valves

With programmable thermostat valves (known as “smart devices”), the room temperature can be set higher or lower at specified times. This makes it easy to heat single rooms individually.

“Island” systems

The time schedule is programmed directly on the thermostat valve. You can enter the schedule directly on the thermostat valve, or with your smart phone via Bluetooth.

Networked systems

In networked systems, the individual thermostat valves communicate wirelessly with a base station that can activate and control each radiator thermostat individually. The base station is connected to the internet and it can be controlled conveniently from a central unit (e.g. the technical building services office).

Additional information

- Smart heating: how to optimise your heating system

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Protect thermostat valves and limit the temperature

Settings on thermostat valves in public zones such as corridors, toilets or showers are often changed. Mechanical stress and the risk of theft are also higher in these areas.

Action
Protect the thermostat valves against changes, and use a theftproof design.

Requirement
Radiators or underfloor heating are controlled by thermostat valves.

In buildings, every additional degree C increases the heating costs by 6 to 10 per cent.

What to do
On some models, the thermostat head has to be removed to set limits; on others, the setting can be made with the thermostat head still installed (see the installation instructions).

1. Set the temperature limit

A: Restrict the temperature range
- The “lower limit” is defined by a pin or clip (usually coloured blue) (e.g. level 2, approx. 17 °C).
- The “upper limit” is defined by a second pin or clip (usually coloured red) (e.g. level 3, approx. 20 °C).

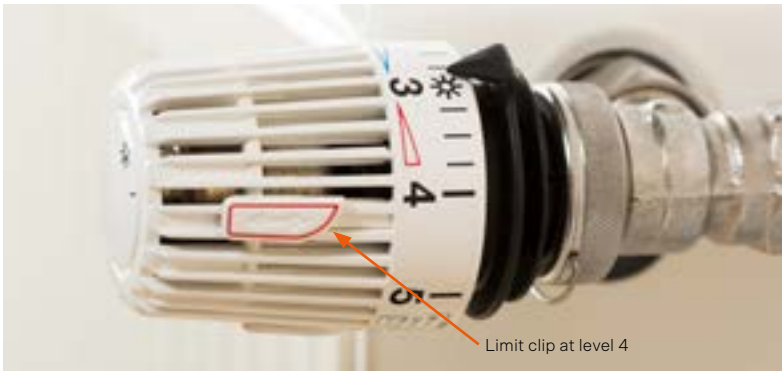
B: Block the temperature at a fixed value
- If you select the same temperature for both limit values, the thermostat head will be blocked. For example: if you set level 3 for the “lower limit” and level 3 for the “upper limit” as well, the head can no longer be rotated and the temperature is set to approx. 20 °C.

2. Cancel the temperature limit

Remove the pins or clips

3. Theft protection

Install any caps or protection that may be needed (These can be obtained from the heating installer)



Costs – effort
- Your own labour for one room with three thermostat valves: ¼ to 1 hour
- New thermostat head: approx. CHF 50 to 80
- Valve and thermostat head: approx. CHF 120
- The entire heating system must be drained and refilled so you can install the new valves. In this case, it is best to replace all the valves in the building at the same time.

Please note!
Make sure that the same temperature is set on all thermostat valves in the same room. (Mechanical) thermostat valves from different manufacturers basically have the same structure. However, they differ as regards design (fixing, setting options) and scaling (temperatures). All manufacturers’ websites offer good, easily understandable instructions on operating their products.

Additional explanations

Public building models

A “public building model” is more robust than a conventional thermostat valve. Also, the modifiable temperature can be restricted within a specified range (e.g. 18 to 20 °C), or set to a fixed value (e.g. 19 °C). This prevents anyone from making unwanted changes to the settings. Public building models of this sort require a special tool (such as a special screwdriver) or explicit specialist knowledge about releasing the lock.

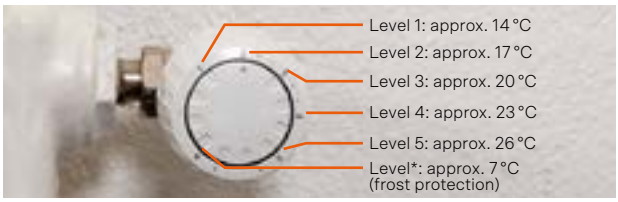
Important: The use of public building models in offices and meeting rooms has not proven successful in practice, because complaints have increased considerably. Install public building models in public zones such as corridors, staircases, toilets and showers.

Theft-proof models

Public building models have integrated theft protection. They are also vandal-proof, and they can withstand loads of up to 100 kg thanks to their better bending strength. “Public building caps” are available to protect various conventional thermostat valves and electronic actuators.

Temperature setting

You will see that the thermostat valves are only marked with numbers or bars, but no specific information is stated about the temperature settings. The scaling may differ slightly from one manufacturer to the next, but the principle is similar for all these devices. Here are some guidance values to show approximately which temperature is set in which position:



The “right” room temperature

The following temperatures are valid as guidelines for rooms/spaces accessible to the public:

- Warehouse, basement: 16 °C
- Areas where people circulate: 17 °C
- WC, showers: 20 to 23 °C

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Vent radiators in autumn

The heating is switched on. The thermostat valves have been checked. Nevertheless, only some areas of the radiators are becoming warm, bubbling noises can be heard and it is too cold in the room. In this case, there is probably air in the system and it has to be vented.

Action

Vent radiators in autumn if they are making noises (bubbling, gurgling or whistling, etc.) or they only heat up partially. In any case, radiators should be vented once every three years.

Requirement

The rooms are heated by radiators. You need a square socket wrench and a container (plastic cup) to collect the water.

Regular venting of the heating system eliminates comfort problems, and energy consumption can be reduced by as much as 15 per cent.

What to do

1. Preparation

- Switch the heating on and turn the heating system up until it is quite warm.
- Switch the circulating pump off (air rises).
- Wait one hour.

2. Vent

- Switch the circulating pump back on.
- Set the thermostat valves to position 5.
- Start with the radiator in the lowest position (usually on the ground floor) and work your way up to the top floor.
- Using a square socket wrench, carefully open the venting valve. At the same time, hold a container under the valve to catch the water.
- Close the valve as soon as all the air has escaped and only water is coming out.

3. Check the pressure – top up the water as necessary

- Check the water pressure with the manometer (pressure gauge) in the central heating unit.
- If the pressure in the heating system is too low, top up the water (see overleaf).

Costs – effort

Your own labour depends on the size of the building. Calculate about 45 minutes' labour to vent 10 radiators.

Please note!

Water coming out of the radiator can be very hot – especially in old systems. It is best to wear gloves when you work.

Don't allow large amounts of water to escape from the venting valve, because you will then have to top up the water again. The water you remove is often black and smelly but – unlike fresh water – is already "degassed" (does not contain oxygen), so it protects the pipes against corrosion.

Additional explanations

Top up the water

The manometer (pressure gauge) in the heating room shows the pressure in the heating system. Check whether the (black) indicator on the manometer is within the setpoint range (green area). If the pressure is below the green area, it is too low, and the water has to be topped up.

Rule of thumb for pressure

For every 10 metres of a building's height, 1 bar of pressure is required. The inlet pressure for the expansion tank must be added to this figure. Pressure of about 2 bar is therefore required for a building with three or four floors.

Water hardness requirement

Please note that heating systems must not be filled with any quality of water you care to use. Boiler manufacturers have defined maximum water hardness requirements for this purpose. According to the Swiss Society of Engineers and Architects (SIA), these values are defined as follows:

Heat output	Max. hardness of filling water
less than 50 kW	max. 30 °fH
50 to 200 kW	max. 20 °fH
200 to 600 kW	max. 15 °fH
over 600 kW	max. 0,2 °fH

fH = French hardness
(degrees of water hardness in France, Switzerland, Italy)

Your local water utility will give you information on the water hardness at your building's location.

Additional information

- Fact sheet on the quality of water used to fill and top up heating and cooling systems, suisstec

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Set the heating curve correctly

On the basis of complaints from users about the room temperature, you suspect that the heating curve is not set correctly. Or: you have noticed that the room temperature remains high at night even though you have implemented a night-time temperature reduction.

Action

Set the heating curve and heating limit correctly on the heating controller for the heating system.

Setting the heating curve correctly will achieve savings of four to six per cent.

What to do

First, perform this action in cold weather (somewhat less than 0 °C) so the room temperature is set correctly for this outside temperature. Repeat the same step when the weather is warmer (a little over 10 °C).

1. Define temperatures and identify critical rooms

- Possibly in consultation with the users, define the setpoint for the room temperature (e.g. 22 °C for offices).
- Find out which rooms are difficult to heat. These include rooms facing the outside or facing north, the top floor and rooms in corner positions.

2. Determine and evaluate room temperatures

See page 4 (Check the interaction between the thermostat valves and the heating curve)

3. Correct the heating curve

Reduce the heating curve by 3 °C during the heating period (see page 2).

4. Adjust the heating limit

Reduce the heating limit by 1 °C during the transition period (see page 3).

5. Observe

Then observe the room temperature for two weeks in each room. Repeat steps 4 and/or 5 until the room temperature is no longer reached (complaints), and correct the set values as required.

6. Set the correct temperature and document it

- Set the correct temperature on the thermostat valves and the room temperature controllers.
- Record the new setpoint values in the logbook.

Costs – effort

- Your own labour: approx. one working day (depending on the size of the building)
- Simple thermometer: CHF 20 to 30
- USB data logger: approx. CHF 100

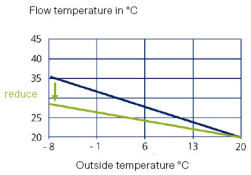
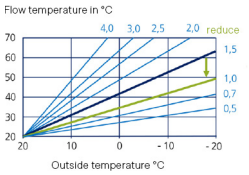
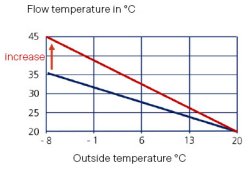
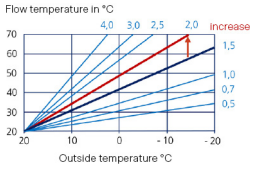
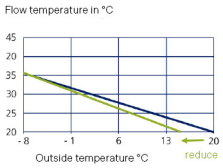
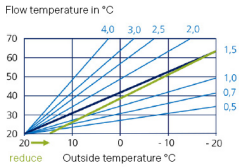
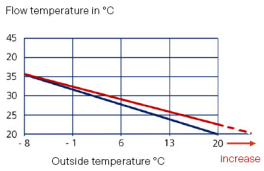
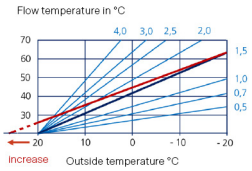
Please note!

- Keep a written record of the original setpoint values and every adjustment in the log book (journal).
- Inform users of the various rooms that the room temperature may be slightly higher in the next few days. Ask users not to adjust the thermostat valve and not to open windows. Users are welcome to document their own experiences.
- Check whether the outside temperature indicator in the heating control is correct. The temperature shown is often wrong (faulty outdoor sensor or solar radiation).
- Check whether the time setting on the heating control is adjusted correctly (e.g. winter time).

Additional explanations

Setting the heating curve

The heating curve (heating characteristic) describes the relationship between the outside temperature and the flow temperature of the heating system.

Diagnosis and action	Analogue controllers	Digital controllers
1. Room temperature is too high in cold weather (below 0 °C)		
Reduce the flow temperature (FT/VT) by setting a flatter heating curve. Rule of thumb for radiators: Reducing the heating curve by 5 °C decreases the room temperature by 2,5 °C. Rule of thumb for underfloor heating: Reducing the heating curve by 2 °C decreases the room temperature by 2 °C.	e.g. set a flatter curve 	e.g. select a 1,0 curve instead of 1,5. 
2. Room temperature is too low in cold weather (below 0 °C)		
Increase the flow temperature (FT/VT) by setting a steeper heating curve. Rule of thumb for radiators: Increasing the heating curve by 5 °C increases the room temperature by 2,5 °C. Rule of thumb for underfloor heating: Increasing the heating curve by 2 °C increases the room temperature by 2 °C.	e.g. set a steeper curve 	e.g. select a 2.0 curve instead of 1.5. 
3. Room temperature is too high in warm weather (over 10 °C)		
Reduce the flow temperature (FT/VT) by setting a steeper heating curve. Rule of thumb: Reducing the heating curve by 3 °C decreases the room temperature by 1 °C.	e.g. set a steeper curve, or reduce the heating limit 	e.g. reduce the heating limit 
4. Room temperature is too low in warm weather (over 10 °C)		
Increase the flow temperature (FT/VT) by setting a flatter heating curve. Rule of thumb: Increasing the heating curve by 3 °C increases the room temperature by 1 °C.	e.g. set a flatter curve, or increase the heating limit 	e.g. increase the heating limit 

Additional explanations

Flow temperatures

The approximate setting for the flow temperatures is based on various guidance values, depending on the heating system, the age and type of the building, and the usage.

Heating system	Outside temperature	–8 °C	15 °C
Radiator heating			
Built before 1980	Flow temperature	60–70 °C	25 °C
Built between 1980 and 2000	Flow temperature	50–60 °C	25 °C
Built between 2000 and 2010	Flow temperature	40–50 °C	25 °C
Built after 2010	Flow temperature	35–40 °C	20 °C
Underfloor heating			
Built before 1990	Flow temperature	35–50 °C	25 °C
Built between 1990 and 2010	Flow temperature	30–40 °C	25 °C
Built after 2010	Flow temperature	30–35 °C	20 °C

Lower flow temperatures can usually be set in buildings with many internal loads (e.g. equipment or lights that give off heat).

Automatic summer-winter switchover

Modern controllers are equipped with an automatic summer-winter switchover feature. Depending on the product, this feature is activated by functions such as “heating limit”, “summer limit” or “ECO”. The advantage of the automatic function is that the control automatically switches off the heating group or pump according to the outside temperature. In this case, it is no longer necessary to switch the heating groups off manually in spring or to switch them on in autumn. However, it is worth checking periodically to see whether this function is working as you want it to.

Setting the heating limit

The heating limit is defined as the outside temperature at which the heating controller switches the heating system off because the building no longer needs to be heated in order to provide the desired indoor temperature (e.g. 20 °C). Once this temperature is reached, the heat stored in the building, solar radiation and heat dissipated indoors (from lighting and computers, etc.) is sufficient to maintain the temperature. The heating limit is set so that the room temperature does not decrease in the transition period. Consequently, the heating limit is always set lower than the room temperature. These factors allow a lower heating limit to be set:

- better building insulation,
- more solid building construction,
- lower room temperature,
- smaller required air change,
- faster response by the heat delivery system.

Setting a lower heating limit reduces the operating period for the heating and allows more savings in the transition period

Guidance values for the heating limit

These values relate to a room temperature of 20 °C.

- Non-insulated old buildings erected before 1977: 15–17 °C
- Buildings erected between 1977 and 1995: 14–16 °C
- Buildings erected between 1995 and 2010: 12–15 °C
- Minergie buildings: 9–14 °C
- “Passive houses”, Minergie-P buildings: 8–10 °C

It is best to make and check changes to the heating limit settings in autumn, at daytime outside temperatures of about 12 to 18 °C and without solar radiation insofar as possible.

Additional explanations

Room temperature control concepts

The heating curve plays an important part in these control systems:

1. Pure flow temperature control
The flow temperature setting determines the room temperature. Changes to the heating curve are noticed immediately in the rooms. For the same reason, users immediately notice incorrectly adjusted heating curves as well (it is either too hot or too cold).

2. Thermostat valve or single room controls
External influences can be taken into account optimally if a local control system (thermostat valves, single-room controllers) is used for the fine adjustment of the temperature in the rooms. For example, these devices switch off the radiator in the room as soon as the sun heats the room on its own. But in this case too, the flow temperature for the heating boiler or heating groups is adjusted via the heating curve.

- **If the heating curve has been set too low**
  If the heating curve is set too low, the required room temperature will not be reached. This leads to complaints, and the heating curve must be "lifted up" as appropriate.
- **If the heating curve has been set too high**
  If the heating curve is set too high, the local control system limits the room temperature so as to avoid overheating the rooms (provided the control system is set correctly). Users do not notice this – everyone is satisfied. But because the flow temperature is too high, there are increased heat losses in the generating and distribution system. Also, the effect of the night reduction is diminished, or there may even be no night reduction at all – because, although the heating controller reduces the flow temperature, it may still be high enough to keep the room at the daytime temperature setpoint. So with this system, an incorrectly set heating curve "covertly" leads to unwanted energy losses and energy costs.

Check the interaction between the thermostat valves and the heating curve

If the temperature in the rooms does not fall at night even though a night reduction has been programmed, the reason could be that the flow temperature is set too high.

- Set all the thermostat valves in these rooms to the maximum temperature (position 5) or dismantle them completely.
- If you have a room temperature controller or manual valves, set them to the highest level.
- Use a thermometer or USB logger to measure the room temperature for two to three days. The correct temperature is determined inside the room, at a height of approx. 1.5 m and without any disruptive influences (solar radiation, heat dissipated by printers, etc.).
- Use the recorded data to check whether the temperature in the rooms corresponds to the setpoint values.

Individual rooms are too cold

If the heating curve has to be increased significantly on account of only a few rooms, the problem can be solved in those rooms:

- Check the flow rate. Is the entire surface of the radiator warm? Are the valves fully open?
- Vent the radiator
- Remove anything blocking the radiator (curtain, furniture)
- (Possibly) remove sludge from underfloor heating pipes
- (Possibly) increase the circulating pump pressure

Minimum flow temperature

If a minimum flow temperature (base temperature) can be set on the controller, it must be checked and set as follows for outside temperatures starting from 20 °C:

- Underfloor heating: 20 °C
- Radiators: 22 to 23 °C

Additional information

- Energy manual for caretakers

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Reduce the flow temperature outside of usage periods

If the flow temperature of your heating system is the same outside of usage hours (at night and weekends) as during the day, heat losses are being increased unnecessarily.

Action

Reduce the flow temperature for the heating system or individual heating circuits outside of usage periods.

Requirement

The building has little insulation, and has a heat generator with power reserves. (For details, see the section on “Determining the potential for reduction” overleaf.)

In old buildings, a night-time temperature reduction can save between 5 and 10 per cent of the energy consumption.

What to do

1. Define the rooms and times

Define the rooms where the temperature should be reduced, and the times when the reduction should occur. This can relate to the entire heating system or only to individual heating groups.

2. Reduce the flow temperature

It is best to optimise the heating at a night-time outside temperature in the region of 0 °C:

- On the heating controller, reduce the flow temperature by a maximum of 2 °C for the defined reduction period.
- Document the changes in the logbook.
- Observe the changes for at least three days. Are the room temperatures maintained when operation finishes and begins (closing and opening times)? Are there condensation problems because the air humidity is too high (see overleaf)?

3. Repeat step 2

Repeat step 2 until you can no longer maintain the temperatures, or until condensation problems occur. At this point, increase the flow temperature again by the value of the most recent reduction (i.e. reverse the last step).

Costs – effort

Your own labour: 2 to 3 hours

Please note!

- For heating systems in very well insulated new buildings and heat pumps designed for maximum efficiency, it makes little sense to reduce the flow temperature temporarily (see overleaf).
- It is also possible to reduce the temperature of the relevant heating groups in one part of the building only (e.g. in the factory hall).
- During holidays (e.g. over Christmas and New Year), the temperature of the entire heating system should be reduced insofar as possible. To do this, select the “Constant night” setting on the heating controller. Please note: After doing this, expect a longer heat-up phase of one to two days.

Additional explanations

Determining the potential for reduction

Poorly insulated buildings (e.g. old buildings that have not been refurbished) lose large amounts of energy through the building envelope during the night. The greater the difference between indoor and outside temperatures, the greater these energy losses will be. When the room temperature falls, the temperature difference also decreases. It is best to determine the potential for the reduction on a night when the outside temperature is 0 °C.

- Measure the room temperature in the evening (e.g. at 5 pm).
- Check whether all the windows are closed.
- Switch the heating off completely.
- Measure the room temperature next morning (e.g. at 7 am).

If the room temperature has fallen by more than 3 °C during the night, a night reduction is worthwhile.

Take response times into account

On account of the heating system's inertia and long response time, the flow temperature can already be reduced 1 to 3 hours before the end of operation (closing time). However, it must also be increased again 1 to 3 hours before operation begins (opening time). The response times of heat delivery systems with radiators are 1 to 1½ hours – considerably shorter than the response times for underfloor heating, which are 2 to 3 hours.

Do not reduce the temperature below 16 °C

In rooms where the setpoint temperature is 20 °C, do not reduce the room temperature below 16 °C during the night. At lower temperatures, there is an increased risk of damp spots and mould. Observe the windows. Condensation water on the edges is a sign of high air humidity (see the fact sheet on ventilation: 02 Airflows).

Take the type of heating system into account

Fossil-fuel and wood-fired heating systems

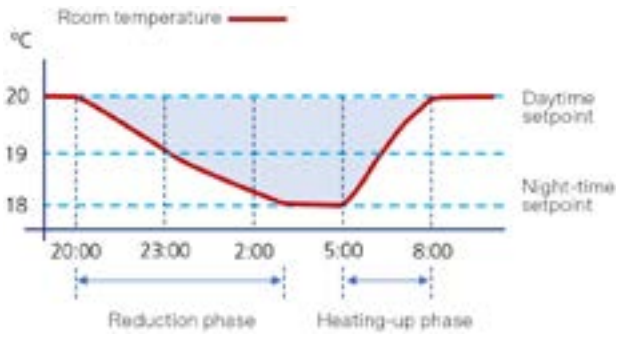
Gas and oil-fired boilers as well as pellet and woodchip boilers are highly suitable for night-time temperature reduction. These are high-performance systems that deliver higher flow temperatures in the heat-up phase again without major losses of efficiency.

Heat pumps (with underfloor heating systems)

It is often necessary to examine whether a night reduction makes sense for heat pump heating systems with underfloor heating. If the flow temperature is increased in the morning to reach the room temperature setpoint, the heat pump runs at a less efficient operating point. This can cancel out the energy savings achieved by the reduction, or can even cause additional costs.

The effect of reducing the temperature at night

The effect of night reduction is proven. If the room temperature is lower at night, the heat losses from the building are also reduced. In the illustration below, the heating is turned down at 8 pm after the end of the operating period, and is turned back up at 5 am, so the room temperature has reached the setpoint again when operations resume at 8 am. This saves around 3.5 per cent of the overall energy consumption (area coloured blue).



Additional information

- Energy manual for caretakers

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11.2021

Minimise the cooling of buildings through the lift shaft

During winter, it's always cool in a lift and in the areas in front of the lift doors on upper floors. Employees often complain about draughts near the lift. These are indications of an uncontrolled flow of cold air through the lift shaft.

Action

Set the temperature control for the shaft ventilation correctly. If the openings in the shaft overhead are not yet equipped with ventilation dampers, consider retrofitting them.

Requirement

Your building has a lift shaft (with or without extraction dampers).

An open 12-metre-high lift shaft causes annual heat losses of 15'000 kWh or more

What to do

Lift shaft without ventilation dampers

Check out the option of retrofitting ventilation dampers (insulated versions) to ensure tight sealing of the openings in the shaft overhead.

Lift shaft with ventilation dampers

Check the values set on the thermostat control for the ventilation dampers:

- Temperature at which the ventilation dampers open (e.g. 35 °C)
- Temperature at which the ventilation dampers are closed (e.g. below 30 °C)
- The exact temperature values depend on the product and are specified by the manufacturer.

Costs – effort

- Costs of materials for the ventilation dampers are approx. CHF 1500 to CHF 2500
- Installation costs: approx. CHF 3000
- Total costs (materials and installation): about CHF 5000

Please note!

- Where the lift shaft adjoins an unheated room or the outdoor climate, the shaft should be heat insulated.
- Ventilation dampers can only be in the "open" or "closed" positions.
- It is advisable to include maintenance of the dampers in the lift maintenance.

Additional explanations

Shaft supply and exhaust ventilation

Many lift shafts pass from an unheated basement through heated storeys into an unheated attic storey, or into the lift superstructure. Cold outside air flows into the shaft through basement windows that are not airtight or are open, is heated by the shaft walls and rises (chimney effect). This creates a suction effect that also draws in warm air from heated rooms through lift doors that are not airtight, resulting in draughts that present a comfort problem. Finally, the heated air flows to the outside through ventilation openings in the shaft overhead.

Retrofitted exterior lift systems

Lift installations are often built onto the outside of a building at a later stage. In this case, the lift and shaft doors penetrate the existing perimeter insulation.

Conventional lift doors are hardly airtight, and they do not meet the thermal insulation and air-tightness requirements for modern buildings. The problem can be solved by inserting an unheated anteroom between the lift door and the heated rooms. The access door to the anteroom can then ensure that the thermal insulation and air-tightness requirements are met.

Safety is key

It is mandatory to comply with local fire protection regulations when retrofitting ventilation dampers.

Emergency exit hatch

It must be easy for the fire service to gain access to the emergency exit hatch from inside and outside. When the emergency exit hatch is in the open position, it must also be kept open by a retaining device that can easily be released.

Note

Until 2015, every lift shaft had to be equipped with an opening for smoke extraction.

However, buildings are becoming increasingly airtight. For this reason, a smoke extraction outlet on the roof will only function poorly if no fresh air can flow into the basement. When the fire protection regulations (BSV) were revised in 2015, the general requirement for an extraction damper was therefore removed (with the exception of fire service lifts).

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11.2021

Reduce the water volume used in washbasins and showers

Taking a shower with a conventional shower head flushes up to 18 litres of hot water down the drain every minute. That's far more than a comfortable shower requires! Also: the volume of water that flows into a washbasin is often more than is really needed.

Action

Take a shower instead of a bath. And don't make the shower too long or too hot. Restrict the water volume for the washbasin and shower, or reduce the outflow with a flow restrictor or a water-saving shower head.

Requirement

Suitable adjustment of the tap or fitting must be possible so that the water volume flowing through it can be restricted.

A water saver or a water-saving shower head will pay for itself after less than one year of use

What to do

1. Determine the water volume

Determine the water volume for the washbasin and shower by filling a one-litre measuring vessel with the taps fully open and measuring the time until the litre measuring vessel is full.

2. Evaluate the measured values

Calculate the water volume for the tap or fitting (litres/minute) based on the measured time (60 divided by the number of seconds for 1 litre). Compare the actual situation to the target situation.

Application	Current status			Target status	
	Filling time	Water volume	Efficiency	Water volume	Efficiency
Washbasin	8 seconds	7,5 litres/min.	Class B	3–5 litres/min.	Class A
Showers	6 seconds	10 litres/min.	Class C	6–8 litres/min.	Class B

3. Optimise the water volume

Reduce the water volume:

- A: by restricting the water volume for the tap or installing a water saver (flow restrictor).
- B: by replacing the shower head with a water-saving model.

4. Document and observe

Note the new values in the logbook. Pay attention to complaints and correct the set values as necessary.

Costs – effort

- Your own labour (measuring and setting the water volume): approx. half an hour per tap or fitting
- Costs of water savers: CHF 10 to CHF 20 per tap/fitting
- Costs of a water-saving shower head: CHF 30 to CHF 60 per shower head

Please note!

In janitorial rooms and kitchens (tea kitchens), it does not make much sense to restrict the water volume because this merely extends the time needed to fill a cleaning bucket or electric kettle with water. What are known as "Ecoboosters" provide a good solution in rooms of this sort. They supply 5 litres per minute in normal operating mode; in boost mode, however, they deliver the full rate of 17 litres per minute (Ecoboosters can be purchased from specialised trade outlets, hardware stores and retail outlets).

Additional explanations

Reduce the water volume in the tap

In good-quality water taps and fittings, the water volume and often also the (maximum) water temperature in the tap can be restricted This is the best and cheapest way of cutting hot water consumption so you can save costs and energy. The manufacturer's installation instructions describe whether and how the water volume in the tap/fitting can be restricted. You will find the instructions on the internet (on the manufacturer's site: search for the model).

What to do:

- Close the outflow to prevent small objects from sliding into it.
- Remove the handle. Depending on the type of tap, you will need an Allen key or a screwdriver to do this. The screw is usually concealed beneath a circular cover.
- The "cartridge" is located under the handle. The cartridge can be used to adjust the water volume and (in some cases) also the tap's maximum temperature. Depending on the model, the water volume can be changed with an adjusting ring or a setscrew.
- Re-assemble the tap.

Retrofitting water savers

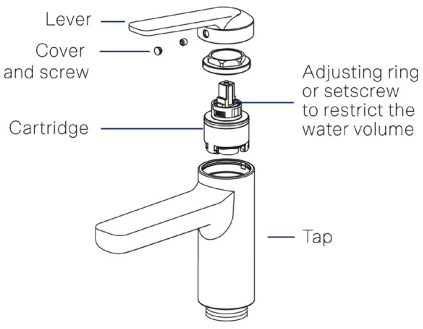

Illustration: KWC (adapted slightly)

Another simple way to reduce the water volume is by replacing the existing spray controller (aerator, mixing nozzle, Perlator) with a water-saving model (water saver, flow restrictor, water-saving inserts).

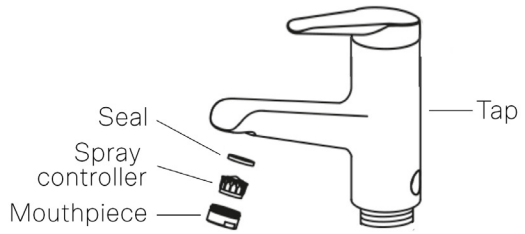

Illustration: KWC (adapted slightly)

Energy label

Good water-saving inserts and shower heads are marked with the energy label. The less water a shower head delivers, the less energy is consumed. So: low flow rates are indicators of high energy efficiency. Hand shower heads in efficiency class A (< 6 litres/minute) have very low flow rates and are mainly suitable for showering in private settings.

Temperature fluctuations

If the installation is inadequate, very severe restriction of the shower head's water volume can cause unpleasant temperature fluctuations. The water is too hot or too cold, and the temperature cannot be adjusted correctly. If this phenomenon occurs, replace the shower head with a model that delivers more water (a higher flow rate reduces pressure losses). Notify your building management when you install water-saving inserts. If the temperature fluctuations persist, you must call in a specialist (possibly for a hydronic balancing procedure).

Additional information

- Enjoy water – save energy with no compromises on comfort
- Efficient hot water supplies for new residential buildings. An overview for building owners
- The energy label for sanitary products
- SVGW (Swiss Gas and Water Industry Association) Fact Sheet: "Pressure and temperature fluctuations"

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11.2021

Adapt the burner output to the actual requirements

Optimal burner output reduces the emissions from your heating and cuts fuel consumption by up to 3 percent.

Action

Determine the burner output that you actually need and adjust the output to the effective demand.

Requirement

You have an old oil or gas burner with output of over 20 kilowatts, but it cannot yet adapt (modulate) its actual output to the demand. Also: this action is only possible for non-condensing boilers and systems without an economiser (for utilisation of waste heat from the flue gas).

What to do

- Read the annual operating hours on the meter. If the burner runtimes are less than the guidance values (see overleaf), this indicates that the burner output is too high.
- The burner's output will also be too high after the building envelope has been insulated.

To reduce the output from oil burners, you can use a smaller nozzle or reduce the throughput. On gas burners, you have to reduce the throughput.

- Have the burner output checked and reset by a specialist.
- After the burner output has been adjusted, the combustion has to be re-regulated and inspected in compliance with the Ordinance on Air Pollution Control (OAPC).

Costs – effort

- If you have the burner output adjusted as part of the annual service, the additional service cost should be between CHF 500 and CHF 1000.

Please note!

- The burner output (thermal output) can only be changed within a certain range. When doing this, follow the instructions from the burner and boiler manufacturer.
- The heating system must always be able to meet the maximum demand for heating power in winter.
- After adjusting the burner output, the burner runtime should also be checked and optimised.

Additional explanations

Minimum operating hours for the burner

For heating systems with a heat generator whose output is more than 20 kilowatts, there are guidance values for the burner's minimum annual operating hours. Failure to reach these values indicates that the burner output is too high.

Heating	With hot water	Without hot water
Single-stage burner	2200 h/a	2000 h/a
Two-stage burner	First stage = 3200 h/a Second stage = 300 h/a	First stage = 1700 h/a Second stage = 300 h/a

Check the exhaust gas temperature

Reducing the burner output will also lower the temperature of the exhaust gas. If this temperature is below 160 °C for brick-lined chimneys (see the burner service report), the exhaust gas temperature must be measured at the chimney outlet after optimisation. It must not fall below 70 °C or there is a risk of soot forming. You can also reduce this risk by slightly opening the fresh air vent at the base of the chimney. For example: you can fix the fresh air vent with a spacer or a screwed joint so that it is always slightly open. The inflow of fresh air will then dry the chimney out and, at the same time, will prevent an unwanted inflow of fresh air through the boiler that would cool it down.

Keep the boiler room clean

All combustion requires air. If this air is contaminated with dust, combustion will be impaired. This will increase pollutant emissions and energy consumption. The burner will also be more liable to malfunctions. Therefore: clean the boiler room at the start of the heating season and also during the heating period whenever necessary (e.g. after construction work).

Check the flame pattern

Look through the inspection window into the combustion chamber at regular intervals. If the flame tips are red, sooty and in contact with the boiler wall, or if the flame pattern is uneven and not symmetrical (perhaps with spark showers), it may mean that combustion is not optimal. In this case, the combustion must be checked and correctly adjusted by a specialist. Periodic cleaning of the boiler and regular adjustment of the combustion can reduce fuel consumption by up to 3%.

Additional information

- Operational optimisation for energy efficiency: operating buildings more efficiently, technical book, 2021
- Replacement of heating systems in larger apartment buildings and condominiums, brochure, 2021
- "Renewable heating" incentive consulting, range of advisory services
- Gas and oil heating systems, dimensioning aid, information sheet, 2017

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Illustration: 123rf.com

10/2022

Insulation of heating and hot water pipes prevents major heat losses

Make sure that all hot pipes are properly wrapped up! That's because large quantities of valuable heat are lost from uninsulated heating and hot water pipes and fittings (manual and slide valves, pumps, etc.).

Action

Insulate all heating and hot water pipes that pass through unheated rooms and spaces. Industrial facilities must also insulate steam pipes (> 90 °C) in heated rooms.

Requirement

To search for heat losses from heating pipes, the outdoor temperature needs to be below 5 °C.

What to do

- Check pipes in unheated rooms (basements, garages, staircases, etc.) by feeling them with your hand. This will enable you to find hot pipes that are losing heat unnecessarily.
- Also check whether the existing pipe insulation is incomplete or defective. Was the insulation:
  - Not added after a repair?
  - Cut open to take a measurement?
  - Mechanically damaged?
- Have hot pipes insulated by an insulation specialist. If you insulate the pipes yourself, measure their diameter and purchase the right insulating shells from a DIY/hardware store.

Costs – effort

- Pipe insulation (shells) with a length of 1 metre and a 90° bend cost CHF 10 to CHF 25 each, depending on their size. There are also additional small items such as PE adhesive tape and aluminium end sleeves.
- Your own labour per metre is about 10 to 20 minutes – depending on how many bends and branches need insulation.
- With heat insulation, CHF 6 to CHF 10 can be saved on energy costs per metre of pipe and per year.

Please note!

- With a little manual dexterity, you can make a good job of insulating straight pipes yourself. However, pipe systems with angled joints, many branches and various fittings are more complex. In these cases, consider calling in an insulation specialist.
- Insulating steam pipes is a challenging task that should be undertaken by an expert.

Additional explanations

Insulation thicknesses

Cantonal energy legislation defines the insulation thicknesses for heat-conducting pipes (from 30 °C to 90 °C) in new buildings (see the specimen regulations of the cantons in the energy sector). These depend on the pipe material and its diameter (see the table).

Inside pipe diameter		Outside pipe diameter		Minimum insulation thickness[1]	
		As the inner pipe diameter is standardised, the outer diameter can vary slightly depending on the material.		Thermal conductivity (λ) λ > 0,03 to ≤ 0,05 W/(m·K) (e.g. synthetic rubber, cellular glass or mineral wool)	Thermal conductivity (λ) λ ≤ 0,03 W/(m·K) (e.g. polyurethane (PUR) or polyisocyanurate (PIR))
DN	inches	mm (approx.)		mm	mm
10	⅜	16	(16–19)	40	30
15	½	20	(20–24)	40	30
20	¾	26	(25–29)	50	40
25	1	33	(30–35)	50	40
32	5/4	42	(36–43)	50	40
40	1 ½	47	(44–49)	60	50
50	2	59	(50–62)	60	50

1 Assistance with execution, EN-103, Heating and hot water systems, EnDK (Conference of Cantonal Energy Directors), May 2020 edition

Insulation of pumps and fittings

Special moulded shells are available to insulate pumps and fittings. These must be obtained from specialised trade outlets. Alternatively, have the work carried out by an insulation specialist.

Special case: insulation of steam pipes

Steam pipes with temperatures of over 90 °C are still to be found in many industrial premises. Even in heated rooms, these still need to be insulated. Because of the high temperatures, not all insulation materials are suitable for insulating steam pipes. It is therefore worthwhile to have steam pipes insulated by a specialist.

Repair defective heat insulation.

Additional information

- Technical insulation in building technology suissetec, 2020
- Assistance with execution, EN-103 Heating and hot water systems, EnDK (Conference of Cantonal Energy Directors)
- You can find insulation specialists on the Isolsuisse website

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Illustrations: zweiweg

10/2022

Eliminate concealed heat losses on decommissioned technical installations

When built-in technical elements such as ventilation ducts, pipes or chimneys are taken out of service, valuable heat is lost between the warm and cold zones unless these elements are dismantled and the openings in the walls are insulated.

Action

You can avoid hidden heat losses by consistently removing old ventilation ducts, pipes or chimneys, and then insulating the openings in the walls.

Requirement

Your building and its technical installations already have quite a few years “under their belt” and have undergone a number of conversions or refurbishments.

What to do

- Check whether your building has technical installations leading from a warm zone into a cold zone that are no longer in use. Be sure to check technical rooms and production areas in particular:
  - Old ventilation grilles and ducts
  - Inactive supply lines/pipes (heating, hot water, pneumatic delivery systems, compressed air, etc.)
  - Unused sanitary venting ducts and wastewater pipes
  - Venting ducts and filler pipes on old oil tanks, air intake openings on disused oil or gas heating equipment
  - Disused chimneys
- Dismantle the technical installations.
- Seal or insulate the openings.

Costs – effort

- You need about half a day’s labour to dismantle, insulate and seal one opening. You also need suitable insulating material for tamping as well as materials for sealing (mortar or a plate).
- Large openings and those between two fire sections are best sealed by a specialist.

Please note!

- If a wall separates two fire sections, a professional, regulation-compliant fire-resistant seal must be installed after demolition.
- An unwanted flow of cold air into a room through an opening can give rise to comfort problems. These can be improved by insulating and sealing the opening.

Additional explanations

Fresh air openings in the heating basement

After an oil or gas heating system has been replaced by a heat pump, the fresh air opening that leads into the heating room can be closed. When the oil heating system is dismantled, the filler pipe and the oil tank vent are also superfluous. They can be dismantled and sealed.

If your oil or gas heating is still in operation, check the fresh air intake opening at intervals and adjust it correctly.
Guidance value for the fresh air opening:

- Forced-air burners, oil and gas
  Opening area [cm²] = power [kW] x 6
- Atmospheric burners, oil and gas
  Opening area [cm²] = power [kW] x 8,6

Disused chimneys

After an oil or gas heating system has been replaced by a heat pump, the chimney is no longer used in most cases. The exception are chimneys used simultaneously by a wood-burning appliance (storage stoves, fireplace stoves, pellet stoves, etc.). Unused chimneys form a “cold air column” in the warm building. Resultant heat losses can be reduced by applying good insulation to the chimney outlet using a diffusion-open material. Any moisture must be able to escape. At the same time, all openings to the chimney (pipes, dampers) in the building must be tightly sealed. If a roof renovation is scheduled, the chimney should be removed as far as the underside of the roof. The entire roof can then be insulated.

In all cases, it is worth discussing insulation and dismantling with the chimney builder in advance to clarify aspects relating to building physics and structural engineering (moisture, dismantling, etc.).

Ventilation ducts

Pay particular attention to disused ventilation ducts. They are often installed close to the ceiling and usually have large cross-sections. Inactive duct networks can have extensive branches and quite often pass through heated rooms. They can cause substantial heat losses.

Pay attention to air humidity

Fresh air can flow through openings into the basement or technical rooms: this will dehumidify the indoor air in winter. If the opening is sealed, the relative air humidity in the room can increase. Monitor the situation and if the room air humidity increases too much (e.g. above 60% r.h.), reduce the humidity by ventilating the rooms regularly.

The position of the opening is critical

The extent of heat losses depends on the temperature difference between the rooms and the size and position of the opening. The greatest heat losses are caused by large openings located close to the ceiling (or, even worse, in it) that lead from a heated room into the open air. Small openings near the floor that lead from a heated room into an unheated one are rather less problematic in terms of energy efficiency. However, they can cause loss of comfort in the heated room (cold floor). Example: an opening measuring 20 cm x 20 cm that leads directly from the indoor to the outdoor climate at floor level causes heat losses of about 300 kWh over one year. The same opening at a height of 2,2 m results in five to ten times more heat losses.

Additional information

- Heat losses through functional openings in building envelopes
  SFOE (Federal Office of Energy)/HSLU (Lucerne University of Applied Sciences and Arts) 2013

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Illustration: zweiweg

10/2022

Reduce the circulating pump's flow rate

Circulating pumps for heating often pump too much water, so they consume electrical energy unnecessarily. If you set the volume flow correctly, you'll not only save electricity but also avoid annoying whistling noises.

Action

At an outside temperature of 0 °C, the difference between the heating group's flow and return temperatures should be higher than 5 K. If the difference is less, the volume flow (flow rate) is too high and it can be reduced.

Requirement

The heating system must be equipped with multi-level or speed-controlled pumps. Two thermometers are also needed: one in the flow and one in the return.

If you can reduce the volume flow from level 3 to level 1, you will save around CHF 250 per year.[1]

What to do

1. Determine the difference between the flow and return temperatures

- Measure the difference between the flow and return temperatures.
- Compare the values to the recommended values (see the graph, overleaf).
- If the temperature difference is currently less than the recommended value, the volume flow is too high and it can be reduced.

2. Reduce the flow rate

Reduce the volume flow (see overleaf).

- Pumps with a step switch: 1 level less
- Speed-controlled pumps: reduce the volume flow by approx. 20 per cent

3. Check the temperature differences again

After half an hour, repeat steps 1 and 2 until the temperature difference corresponds to the recommendations.

4. Document the new settings

- Note down the new values in the logbook.
- If there are complaints that it is too cold in the rooms, go back one step and increase the volume flow again.

Costs – effort

Your own labour for one central heating unit with multiple pump groups (including follow-up inspection): approx. 4 hours

Please note!

- Ideally, the optimisation should be carried out when the outside temperature is about 0 °C, because the differences are more clearly visible at this temperature.
- Accurate thermometers are required to determine (small) temperature differences – so check whether the two thermometers are measuring correctly. If there are any discrepancies, calibrate the thermometers or replace them.
- Heating systems respond relatively slowly to changes, so they cannot be adjusted for optimal operation in a matter of minutes or hours.

Setting the volume flow

A: Pumps with multiple speed levels

With a step switch, the operating mode is set permanently (uncontrolled pump). The higher the speed level, the more water is pumped.

- Reduce the volume flow by selecting a lower speed level on the switch.

1 Applies to a pump with power consumption of 400 watts at the first level and 800 watts at the third level.

Additional explanations

B: Speed-controlled pumps with various setting options

On newer pumps, the volume flow can be adjusted with the help of various functions (e.g. automatic, via proportional pressure curve, or via constant pressure control). These pumps are usually delivered with the "automatic" factory setting. With this setting, the pump adjusts automatically in the specified delivery range. This process requires some time – so let the pump run for at least one week before you check the pump setting and select a different operating mode, if necessary.

Setting for two-pipe heating systems

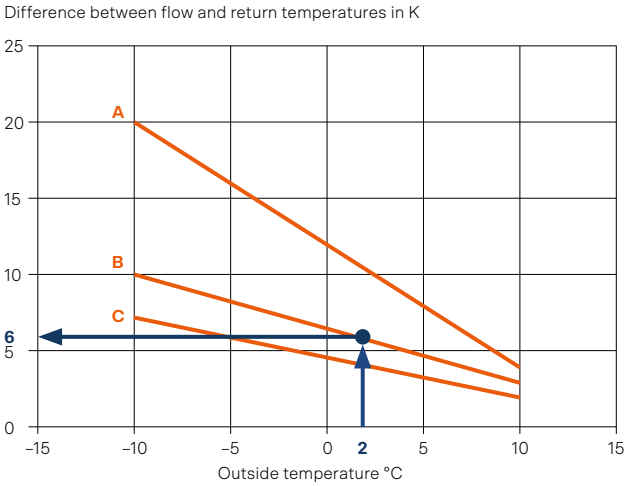
- "Automatic" mode: this mode adapts the pump's delivery rate to the actual heat demand in the system.
- Proportional pressure control mode: the delivery head increases in proportion to the volume flow. This is suitable for systems with high pressure losses in the distributor pipes (two-pipe heating systems with thermostat valves, primary circuits, cooling systems). Not suitable for underfloor heating.

Settings for underfloor and one-pipe heating systems

- "Automatic" mode: this mode adapts the pump's delivery rate to the actual heat demand in the system.
- Constant pressure control mode: the flow rate is adjusted to the current heat demand and the delivery head is always kept constant. Select the lowest curve at which the pump still provides the required delivery pressure.

Temperature difference as an indicator

The optimal difference between flow and return temperatures depends on the type of heat delivery system (underfloor heating, low-temperature radiator, high-temperature radiator) and on the outside temperature. The graph shows guidance values for the optimal temperature difference for the systems just mentioned.



A: Radiators with a flow temperature > 60 °C
B: Low-temperature radiators < 50 °C
C: Underfloor heating

Example: With an outside temperature of 2 °C, the optimal difference between the flow and return temperatures for a heating system with low-temperature radiators is 6 K.

Improved efficiency for the heat generator

As well as cutting the costs of electricity for the circulating pump, an optimal temperature difference boosts the efficiency of heat pumps and condensing boilers.

Additional information

- Dimensioning aid for circulating pumps
- Circulating pumps in heating systems, suissetec
- Use underfloor heating the right way, suissetec

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11.2021

Defrost the right way and your costs will melt away!

Ice forming on the evaporator is a reliable indicator of how well the defrosting function is working. If an uneven layer of ice forms and the ice is thicker in some places, the defrosting process should be checked and optimised as necessary.

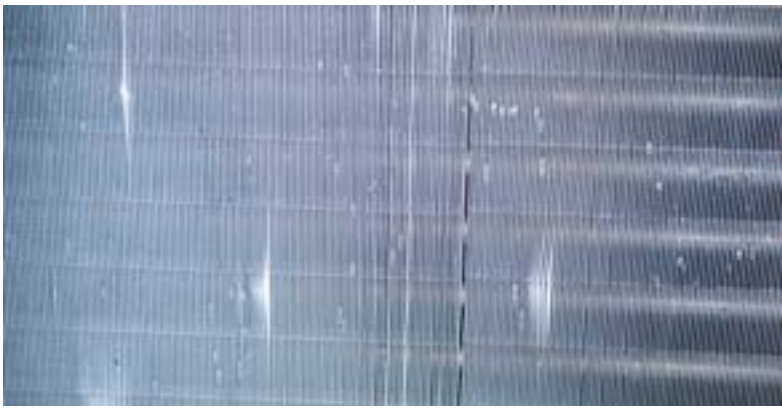
Action

If the defrosting function is adjusted correctly, the air-to-water heat pump will consume less energy.

Requirement

Ideally, the defrosting process should be checked and optimised when the outside temperature is around freezing point (minus 2 °C to plus 5 °C).

With optimally adjusted defrosting, you will save between CHF 500 and 1000 per year (depending on the size of the system).



What to do

The goal is to find the minimum defrosting temperature at which there is no longer any ice on the evaporator after the defrosting process. The best way to do this:

1. Determine the temperature of the evaporator fins
Initiate the defrosting process (the evaporator must be iced up). At the point in time when all the ice has melted away, measure the temperature on the fins.

2. Set the defrosting temperature and time
Set the temperature you measured (see step 1) as the new defrosting temperature on the defrosting thermostat. You must also set the maximum defrosting period (e.g. 25 minutes[1]). By doing this, you make sure that the defrosting process ends if the temperature is not reached.

3. Enter the drip-off time
Check the drip-off time and set it so that the remaining water can drip off the fan before the compressor and the fan switch on again (e.g. 3 minutes).

4. Restart the heat pump

Costs – effort

A service technician needs about 1 to 2 hours for the optimisation, which will cost between CHF 300 and 400.

Please note!

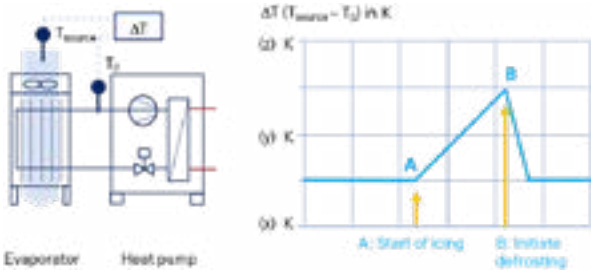
- The defrosting process is permanently programmed in the heat pump. Setting the defrosting temperatures correctly requires a certain amount of experience. Also, some controls are user-friendly while others are rather more complex to operate. In case of doubt, you can also have the service technician change the defrosting temperature.
- Check the defrosting function once every 3 to 5 years.

1 The time depends on the device and location.

Additional explanations

Optimum between icing and defrosting

An iced-up evaporator makes the heat transfer much worse, so the heat pump's seasonal performance factor also deteriorates. But if defrosting is performed too often, the energy consumed by defrosting will increase and the heat pump's seasonal performance factor will decrease. This makes it important to find the right setting that ensures the optimum balance between "icing" and "defrosting".



Different defrosting intervals

There are three ways of triggering the defrosting process:

1. Defrosting based on a fixed time interval

Example: At outside temperatures below 5 °C, defrosting takes place after 1 hour of operating time for a fixed period of 10 minutes – even if the evaporator is not frozen. This principle is simple, safe and reliable. On the other hand, it is poor in terms of energy efficiency because defrosting takes place even when it is not necessary.

2. Defrosting based on a fixed defrosting interval

Example: Defrosting takes place after 1 hour of operating time, but the defrosting process is not geared to a fixed time; instead, it only lasts as long as necessary. This variant is more energy-efficient than defrosting based on a fixed interval.

3. Demand-actuated defrosting

The defrosting intervals and times are variable, and are automatically adapted to the effective demand. A self-learning control system triggers defrosting at fixed intervals at the beginning of the heating period. In this case, the surface temperature of the evaporator is measured continuously and the duration until the evaporator is completely "ice-free" is determined. The next defrosting process is shortened or extended accordingly. This is a complex solution in terms of control technology, but it is definitely the most energy-efficient option.

The main defrosting methods

A: Reverse-cycle defrosting (for 80 per cent of systems)

With this method, the refrigeration circuit is reversed. The evaporator becomes a condenser and the heat causes the ice to melt. Defrosting settings:

A: Fixed time control: operating time of 1 hour, followed by defrosting for 10 minutes.

B: Time control with variable end: operating time of 1 hour, followed by defrosting for as long as necessary. Or: both operating time and defrosting are continuously redefined by the control (demand-led). Correct adjustment of the defrosting is somewhat more complex and time-consuming.

B: Hot gas bypass defrosting

The hot gas is fed to the evaporator directly downstream of the compressor, and it defrosts the evaporator. The operating time for hot gas bypass defrosting processes is 10 to 15 per cent of (overall) operating time, which is rather long. No heating operation is possible during this period (reduced output).

C: Natural defrosting (up to 5 °C)

Natural defrosting works up to an outside temperature of 5 °C. To do this, the heat pump is switched off and the fans continue to run. The ice melts away due to the "warm" ambient air. This is a highly energy-efficient solution.

D: Electrical defrosting

The evaporator is defrosted with an electrical insert. Simple – but not energy-efficient.

Additional information

- Guideline with measures to optimise refrigeration systems
- Heat pumps: planning – optimisation – operation – maintenance

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Clean evaporators on heat pumps regularly

Evaporators on air-to-water heat pumps become soiled over time. The constantly increasing film of dirt on the fins diminishes the heat transfer. This leads to higher energy consumption and higher operating costs.

Action
Clean the evaporator every 2 years. Cleaning intervals depend on the location, and they may be considerably shorter or longer depending on the degree of soiling.

Requirement
A squeaking or whirring fan that causes louder noises than usual indicates that the evaporator is soiled.

Systems with a heavily soiled evaporator consume up to 45 per cent more energy.

What to do
The evaporator becomes soiled by dust, pollen, leaves or exhaust gases from the ambient air. Therefore, clean it as follows:
- Study the manufacturer's operating manual (safety, cleaning instructions)
- Switch the heat pump off and disconnect it from the power grid (switch it off via a circuit breaker, or remove the fuses)
- Remove the cover
- Clean the evaporator from both sides.
- Be careful not to damage the fins as you do this (also see overleaf).
- Clean the housing, grid(s) and fan
- Fit the cover back in position
- Switch on the evaporator and the fan
- Perform the listening check again.
- If the fan is still squeaking or whirring, contact the service specialist for the heat pump.

Costs – effort
- Your own labour: approx. 2 hours per evaporator
- Cost of fin comb: approx. CHF 25, available from refrigeration and air conditioning equipment wholesalers

Please note!
- It is best to clean the heat exchangers in autumn, before the heating season, when the trees have already shed their leaves.
- If you clean earlier in the year, it is best to do so after pollen is released into the air – in June.

Additional explanations

Cleaning methods

High-pressure water cleaner: When using a high-pressure water cleaner, make sure that the water is always sprayed straight onto the evaporator so the fins are not deformed.

Compressed air or vacuum cleaner: Wherever dirt does not stick, an industrial vacuum cleaner or compressed air can be used for cleaning. Rule when using compressed air: Always blow the air straight onto the evaporator to avoid bending the fins out of shape. Please note: When used indoors, compressed air blows the dry dust into the room.

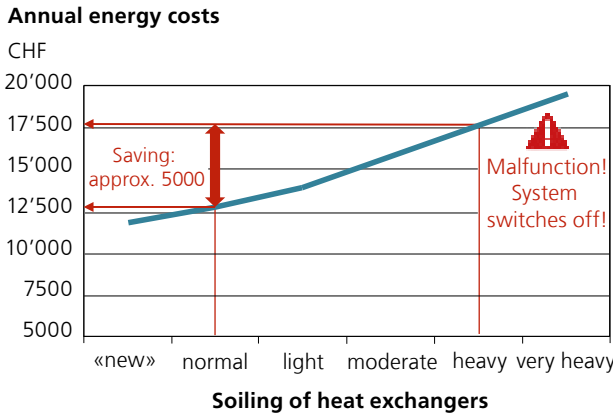
It is essential to observe the manufacturer's instructions for all cleaning methods that involve high pressures. The instructions usually state the maximum pressure, the minimum distance to be kept from the air or water jet (e.g. 200 mm), and the working direction (e.g. perpendicular to the pipe register, maximum deviation ±5 °).[1]

Severely deformed fins

If the fins on the heat exchanger are severely deformed, full flowthrough will be impeded. The exchanger's "power" diminishes and energy efficiency suffers. Deformations are caused by mechanical damage, for example by spraying the fins obliquely with the high-pressure cleaner. If more than one quarter of the fins are deformed, you should re-align them. To do this, use the devices known as "fin combs". If you do not have any, or if the fins are very severely deformed, you can do this by hand. Align one fin at a time, using long-nose pliers and a 2-mm screwdriver.[1]

When an increase in consumpti on goes unnoticed

Cleaning the evaporator improves heat transfer between the ambient air and the refrigerant. This increases the efficiency of the heat pump system because without cleaning, the energy consumption increases continuously – but you do not notice this happening. A study by the German Mechanical Engineering Industry Association (VDMA)[2] shows that if refrigeration systems (which, of course, include heat pumps) are not maintained for two years, they exhibit a 25 to 45 per cent increase in energy consumption.[3] Air-to-water heat pumps are likely to become soiled rather less quickly than refrigeration systems, because the evaporator is cleaned slightly during every defrosting process. This washes out some of the dust or pollen. However, leaves and grease remain behind and form deposits, so the evaporator gradually becomes clogged and energy efficiency also decreases significantly.



Annual energy costs of a system with (evaporator) power of 210 kW with different degrees of soiling of heat exchangers.

Additional information

- Guideline with measures to optimise refrigeration systems
- Guide to refrigeration: maintenance and energy
- Heat pumps: planning – optimisation – operation – maintenance

Sources
1 Guideline with measures to optimise refrigeration systems
2 Research Council for Refrigeration Technology of the German Mechanical Engineering Industry Association (VDMA), Study FKT 37/97, Saving Energy through Maintenance, 2016
3 Guide to refrigeration: maintenance and energy

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Energy data – the key to tracking down savings potential

A faulty controller, a change to a setting or a major leak in the compressed air system: these are everyday occurrences that often cause increased energy consumption. If the error or fault is only discovered late in the day, the costs can quickly mount up.

Action
Evaluate the operational and consumption data recorded by your building management system at regular intervals to avoid “energy leaks”.

Requirement
Your building has a building management system.

If you track down possible potential for saving energy at an early stage, you will easily save 5 to 10 percent of your energy costs.

What to do
1. Compare energy consumption data
Regularly compare the recorded energy consumption data with the data for the previous period (see “Please note”). If consumption increases abruptly for no obvious reason, analyse the cause.

2. Analyse the recorded data
Each week or month, compare the other recorded data (statistics and trend curves) with the data for the previous period. If there are any irregularities, investigate their cause. (Also see page 2: Reasons for discrepancies)

3. Check the displayed data
Check the displayed values at regular intervals
- Are the current values (temperatures, pressures, etc.) plausible?
- Are the setpoints (e.g. temperatures) maintained?

Costs – effort
Your own labour: approx. 1 to 3 working days per year, depending on intensity

Please note!
- Like all other data, energy consumption data should be compared to the previous year’s figures at least once a year or, better, every quarter (for small businesses), once a month (medium-sized businesses) or even once a week.
- The values should be plausibility-checked both in summer and in winter.

Additional explanations

Purchased at high cost – but inadequately used

Quite often, costly building management systems are only used to generate alarms in case of malfunctions. Of course, alarms are important and they are the basis for short response times. But modern building management systems can do far more than this.

Thanks to graphic displays, they allow targeted monitoring and optimisation of complex technical systems and control processes. This eliminates the requirement for specialists to measure temperatures, consumption figures or system pressures in a plant. Also, for example, reduced temperatures at night and outside of usage times can be monitored with no need for the responsible individual to be on the premises.

Some typical “mistakes”

“Operating with no benefit” is the most obvious mistake that can be identified in many systems by evaluating the data from the building management system. This category includes, for instance, systems and machines that operate at night although the entire workforce is at home and the plant should be inactive: air compressors are a classic example of this.

Other frequent mistakes:

- Rooms are heated and cooled at the same time
- Heating pumps operate in summer
- The ventilation system cools during winter
- The heat recovery unit doesn’t work
- No night-time temperature reduction is set
- Free cooling is installed but is not operating

Possible reasons for discrepancies

Energy consumption discrepancies that are revealed by the data from the building management system can have various causes and do not always have to indicate a problem:

- Changes to production volumes
- Conversions, extensions or demolitions
- Increased or reduced employee numbers
- Different numbers of heating degree days depending on climate conditions
- Incorrectly calibrated probes/sensors
- The building management system does not display the correct values
- Changes to operating times or settings such as temperatures, pressures, etc.
- Refurbishment or extension of supply systems such as heating, refrigeration/cooling, hot water, compressed air or ventilation (e.g. installation of new chilled beams).

Additional information

- Energy efficiency in functional buildings, Building Network Initiative (GNI)

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11.2021

Keep heat inside buildings by closing doors and gates

Heat escapes continuously through open doors and gates – a costly state of affairs that can often be prevented. The solution? It all comes down to well-informed and attentive employees.

Action

By consistently closing external doors/gates as well as doors inside a building, you can take action against energy wastage.

Requirement

This action can be put into practice anywhere and is simple to implement.

What to do

Doors and gates that open to the outside

- On sliding doors, activate winter mode (so the door does not open fully)
- Close industrial doors and gates again immediately after goods have been loaded or unloaded
- Instruct employees to enter the building through the doors, not through the gates
- Close under-used public entrances
- Only open roller doors/gates to the necessary height

Doors and gates inside the building

Make sure that doors between heated and unheated zones are always closed in winter.

- Doors from offices or sales areas into corridors
- All doors that open onto staircases
- Doors from porches into warm areas
- Doors from a heated ground floor into an unheated basement
- Doors from a heated upper floor into an unheated attic storey
- Steam bath and sauna doors

Costs – effort

- You need about one hour to instruct the employees. You also need to inspect the premises from time to time and address “lapses” (open doors and gates) as necessary.
- By setting a sliding door to winter opening mode, heat losses through the door can be reduced by 30% (see next page).

Please note!

- If a door or gate is constantly open, investigate the reason. There may be an operational cause that you can easily rectify. Perhaps the door opens too slowly, so forklift drivers cannot complete their work in the time allowed. Simple technical solutions can often provide a remedy in cases such as these. Increase the door’s closing speed, for example, or do not open it to the full height.

Additional explanations

Only open doors and gates as far as necessary

There is a linear relationship between heat losses through an open door or gate and the door width, but these losses increase disproportionately in relation to the door height. It follows that doors and gates should not be opened any higher than is absolutely necessary. The minimum required opening dimension for a door in areas used by people is 2,10 metres.

In winter, screens or panels can be used to reduce the door height to the optimum dimension of 2,10 metres. In customer areas, where the visual impression is important, use an invisible glass panel for this purpose. Most automatic sliding doors have a "winter opening" mode that reduces their opening width. A width of 1 metre has proven suitable – this allows a twin pram with a width of 80 centimetres to pass through easily.

The example of a chemist's shop with a sliding door (1,40 metres wide and 2,20 metres high) shows how much energy-saving potential is available. The door is open for an average of 42 minutes per day. In the winter half of the year, heat losses through the door can be reduced by 30% if the door is only opened to a width of 1 metre in winter opening mode.

Retrofit sensors on revolving doors

Revolving doors prevent warm indoor air from flowing freely to the outside. But every time they revolve, they "scoop" warm air outwards and cold air inwards. To prevent unnecessary heat losses, the revolving door can be equipped with a sensor. When this is done, the door will only revolve when a person is present in the revolving area.

Retrofit door closers

If doors always remain open despite every effort to inform people, a door closer can provide an elegant solution. A simple door closer costs about CHF 50. Anyone who is technically skilled can install the closer themselves on most doors (except for glass doors and special metal doors).

Heated air curtain

Check your heated air curtain regularly to make sure it does not "leak". Check whether there is an opening between the blower assembly and the building envelope (outer wall) through which warm air can escape to the outside. In these cases, heat losses can be prevented by a lateral screen or panel that seals the opening. The air from the heated air curtain flows out at 30 °C to 35 °C and mixes with the cold outside air. If the indoor temperature becomes too high in warm seasons (or when the door is closed and the heated air curtain is active), you should ask your supplier to determine whether the temperature at which the heated air for the curtain is blown out can be adjusted to the effective temperature (outside temperature).

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Illustrations: zweiweg

10/2022

Reduce heat losses through open (industrial) doors and gates

It still often happens that a door or gate is left open while the forklift unloads a truck and transports the goods into the hall. A modern control is the remedy for this problem. It will optimise door opening and minimise heat losses.

Action

Keeping doors and gates open for short periods will minimise heat losses and improve comfort by helping to prevent temperature drops and draughts.

Requirement

You have modern high-speed doors or a sensor-actuated door control (e.g. with a laser scanner).

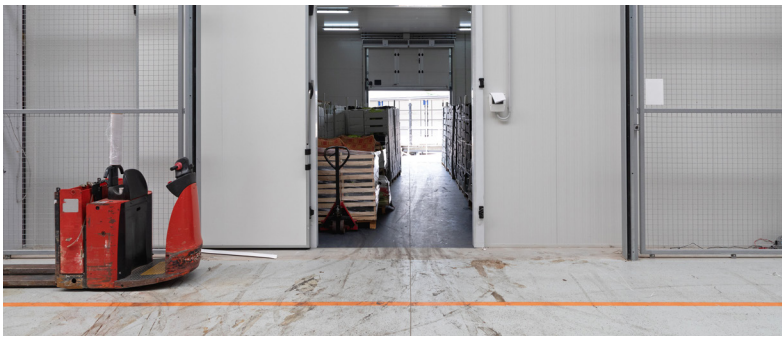
What to do

Intermittent operating mode for high-speed doors

- Check whether your high-speed doors (high-speed spiral doors or foil-coated roller doors) remain open all the time while goods are loaded and unloaded.
- Check whether you can reduce the opening time on the control (e.g. to 15 seconds) so that the door closes after every operation and only opens again when required.

Optimise door opening

- On sensor-controlled doors, check whether the opening height matches the actual requirement. The height of a standard forklift vehicle is about 2,2 metres – so even if the door is 4 metres high, an opening height of 2,5 metres is sufficient.
- Discuss heights with your employees based on their experience and practice, and adjust the door opening height accordingly.



Costs – effort

- To check and adjust one door, you will need between half an hour and one hour.
- Switching over from continuous to intermittent operation reduces heat losses through the door by 10% to 30%, depending on the application and the building.
- Reducing the opening height by 1,5 metres (from 4 metres to 2,5 metres) reduces heat losses through the door by 40% to 60%.

Please note!

- Safety requirements must be met at all times!
- There is no optimal period for doors to remain open. You need a solution that is tailored to your usage (your process).

Additional explanations

Avoid draughts

If two doors opposite each other are open at the same time, heat losses will increase noticeably and comfort will be impaired due to the draught. In situations of this sort involving draughts, the heat demand is 6% to 11% more than when the two doors are not open at the same time.

Slow- and fast-running doors

According to a German study, three types of door – sectional doors, roller doors and high-speed spiral doors – have a market share of over 90% in the industrial construction sector. Sectional doors and roller doors with slats close at an average speed of around 0,25 m/s and are classed as “slow-running” or “low-speed” doors. Fast-running doors include high-speed spiral doors and foil-coated roller doors. Their average speed of about 0,7 m/s makes them around three times faster than slow-running doors.

With their higher speed, fast-running doors can react more rapidly to effective demand. Their opening times are significantly shorter, so the heat losses in winter are correspondingly lower.

For doors that only open infrequently, however, the opening speed is of secondary importance. Good thermal insulation of the doors is the important factor here. In such cases, a less important part is played by heat losses through slow-closing doors whose opening and closing process often takes longer than the time for which the door is open.

Unload trucks inside the building

If your hall is large enough, you can drive trucks into it for loading and unloading. The doors/gates are only opened when the vehicles pass through them, after which they are closed again. This allows you to reduce heat losses through open doors by 70% to 80%, depending on the type of door. Drawbacks of this measure are the additional space required for the trucks and the exhaust gases from them that pollute the indoor air.

Situation analysis

It may well be worthwhile to commission an expert opinion from a door and drive technology specialist (for example: experts working for the supplier) on your doors and the work processes related to them. They can show you actions that you can take immediately:

- Which doors/gates include the necessary safety elements so that their opening time or height can be adjusted without any further interventions?

You will also learn which further actions are suitable in your case:

- Where are refurbishments, additions (such as air curtains and airlocks) or possibly replacements due within a suitable period?

Additional information

- Different door systems in industrial buildings, taking account of energy, building climate control and economic aspects, Technical University of Munich (TUM), Chair for Building Technology and Climate Responsive Design, 2013
- Gates – doors – windows
  FCOS (Federal Coordination Commission for Occupational Safety) information brochure
- Doors and gates
  Specialist documentation on safety,
  Swiss Council for Accident Prevention (BFU)
- You can find specialists in door/gate and drive technology at: Interest group for gate systems, drive systems and door systems (IGTAT)

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Illustration: 123rf.com

10/2022

Adapt the operating times for the ventilation to effective usage

If rooms are ventilated (intensively) outside of usage hours or if the air seems “stale”, these are signs that the operating times set for the ventilation are not optimal.

Action

Adapt the operating times of the ventilation system to the effective demand and room usage. Outside of usage times, switch the ventilation system off entirely, or reduce it.

Requirement

The ventilation system control must have a timer programme.

If the ventilation can be switched off every day from 8 pm to 6 am, its energy consumption will decrease by 40 percent

What to do

1. Record the initial situation

Note the current settings for the timer programme in the logbook (plant journal).

2. Determine the usage times

Ascertain when the individual rooms are used. This is the basis for the ventilation system’s operating times.

3. Set the operating times

- When usage begins, switch the ventilation system on. If the air quality is already giving rise to complaints, switch the system on for 15 minutes to a maximum of 30 minutes before usage begins (this is known as “pre-flushing”).
- When usage ends, switch the ventilation system off immediately. Post-occupancy ventilation makes no sense in most cases.
- Depending on the required airflow, the ventilation system can be switched on and then off at intervals of 15 minutes (intermittent operation).
- If a room is only used by a few people for a certain period, the system’s power can be reduced (e.g. from level 2 to level 1), or intermittent mode can be switched on.

4. Note, observe and correct

- Note the new values in the logbook.
- Observe the users, pay attention to complaints and correct the set values as necessary.

Costs – effort

- Your own labour (recording usage times, setting the timer, updating the logbook): approx. 2 hours per ventilation system (monobloc)
- Air quality measurement (CO_2, air humidity): CHF 200 per measuring point

Please note!

- In buildings that are ventilated via the windows, the operating times of the ventilation system can be reduced additionally outside of the heating period.
- Important: the usage time is often not the same as the actual period of presence. Users are frequently present in the rooms before the official attendance time.
- Record every adjustment of the set values in writing.
- Use a timer programme to switch the ventilation system off entirely in summer (do not blow any warm air into the rooms) and during public holidays and (works) holidays.
- Night-time cooling in summer is significantly more effective via window ventilation than with the ventilation system.

Additional explanations

Considerations regarding usage

The following questions will help you to specify usage:
- Which rooms does the ventilation system supply?
- How is the room used?
  - Office, meeting room, laboratory, etc.
- How intensively is the room used?
  - Occupancy throughout the day
- Are the rooms' usage times known?
  - Weekdays, weekends
  - Public holidays, works/company holidays

Which tasks does the ventilation system perform?
- Hygiene ventilation
- Room cooling or heating
- Humidification or dehumidification of the supply air

Pay attention to the air quality

It is difficult to make generally valid statements about optimal indoor air quality because people react differently to air pollution. Nevertheless, CO_2 content and air humidity are good indicators for assessing air quality. For this reason, they should be verified by measurements. As regards CO_2 content, the IDA values (IDA = Indoor Air) provide good guidance:
- Less than 800 ppm: high air quality (outside air)
- 800 to 1000 ppm: medium air quality
- 1000 to 1400 ppm: moderate air quality
- More than 1400 ppm: low air quality

For the purposes of air quality and energy consumption, ventilation in offices should be switched on when the CO_2 content is 1000 ppm

If it is impossible to guarantee the required air quality, the operating times of the ventilation or the airflow must be gradually increased again. The air quality should also be checked once or twice during the heating period, at intervals of 10 to 12 weeks.

Operating times for the ventilation system

A rule of thumb states that the ventilation system operates only when the room is in use:
- A post-occupancy operating period is not required;
- A short pre-occupancy operating period (pre-flushing) may be appropriate.

Example: usage times, office A

Work starts 6:30 am, work ends 6:00 pm
- Ventilation ON: Monday to Friday: 6 am to 6 pm
- Ventilation OFF: Monday to Friday: 6 pm to 6 am
- Ventilation OFF: weekends, public holidays, works holidays

Example: usage times, office B

(level 1 = gentle, level 2 = intensive)
Work starts 6:30 am, work ends 6:00 pm
- Ventilation level 2: Monday to Friday: 6 am to 8 am
- Ventilation level 1: Monday to Friday: 8 am to 1 pm
- Ventilation level 2: Monday to Friday: 1 pm to 3 pm
- Ventilation level 1: Monday to Friday: 3 pm to 6 pm
- Ventilation OFF: Monday to Friday: 6 pm to 6 am
- Ventilation OFF: weekends, public holidays, works holidays

Example: usage times, school classroom

School begins 7:30 am, school ends 5:00 pm
- Ventilation ON: Monday to Friday: 7 am to 5 pm
- Ventilation OFF: Monday to Friday: 5 pm to 7 am
- Ventilation OFF: weekends, public holidays, school holidays

Additional information

- "Ventilation and air conditioning systems – general principles and requirements", SIA standard 382/1 (charge payable), www.sia.ch
- Indoor air quality, www.lungenliga.ch
- The indoor air quality (IDA value) is described in EN 13779.

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The right airflow improves the quality of the room air

Complaints about room air – such as “it’s muggy”, “it’s too dry” or “there’s a draught” – are signs that the airflow is not adjusted correctly and must be checked.

Action
Adapt the airflow for the ventilation system to match the actual requirements in the rooms.

Requirement
It must be possible to control the airflow fan with a frequency converter, a step switch or an EC (electronically commutated) motor.

If the airflow is halved, the energy consumed by the ventilation decreases by 80 percent

What to do
1. Record the initial situation
- Determine the airflow setting (supply and exhaust air). These values should be recorded in the commissioning record for the ventilation system. If the data is missing, a ventilation specialist can determine the volume flows.
- Note the current supply and exhaust airflows in the logbook (plant journal).

2. Measure the air quality
Use a data logger to determine the air quality in the room for a period of about 2 weeks (CO_2 concentration and air humidity).

3. Compare the measurement results with the default values
- Compare the measured values with the default values (see page 2) for CO_2 content and relative air humidity and adapt the airflows if necessary (see page 2).
- Coordinate the supply and exhaust airflows.

4. Note, observe and correct
- Enter the newly adjusted airflows and setting values (frequency and speed) in the logbook.

- Observe the users (are there any complaints?) and correct the settings if necessary. In case of doubt, measure the CO_2 values and the humidity again.

Costs – effort
- Your own labour (measurements, settings, updating the logbook): approx. one working day
- Air quality measurement (CO_2, air humidity): CHF 200 per measuring point

Please note!
- Depending on the room usage, peak CO_2 values may occur briefly with no need to increase the airflow permanently (e.g. in meeting rooms).
- In terms of energy efficiency, it is worth checking all rooms even if there are no complaints. It could be that too much air is being blown in without anyone noticing.
- Pay attention to additional requirements for the rooms (such as overpressure or underpressure).
- For plants with a recirculating air system, the minimum proportion of outside air may be reduced to save energy.
- On ventilation systems with old motors (belt drive), the speed can be changed by changing the size of the drive pulley.

Additional explanations

Setting the volume flow

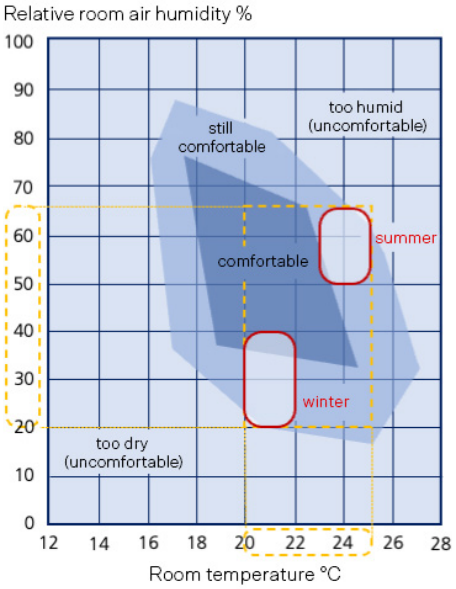
The volume flow (m^3/h) is the airflow that is fed to the room. Depending on the ventilation system, either fresh air only or fresh air with a percentage of recirculated air is blown in. The volume flow can be changed as follows:

- Change the levels on the relevant fans (e.g. levels 1 and 2)
- Adjust the speed of fans with a frequency converter (e.g. continuous control based on limit values such as CO_2 and temperature)
- Adjust the speed on fans with EC (electronically commutated) motors (using the integrated motor electronics)
- Cycle the system (switch on/off) over the operating times for an average/moderate volume flow
- Define seasonal operating times or levels

The supply and exhaust airflows must be coordinated with each other.

Temperature and relative air humidity

When assessing comfort, the relative room air humidity is an important factor as well as the temperature. To ensure that the ventilation system operates economically, both values must be adapted to outside climate conditions (see the illustration).



How to determine the default values

The theoretically required volume flow can be calculated on the basis of the number of occupants, the usage or the room type. The following table provides guidance values for the calculation:

Room type	Outside air volume flow (m^3/h/person)	Targeted CO_2 concentration (ppm)	Requirements for room air (category)
Office	36	800–1000	IDA 2 – medium
Open-plan office	36	800–1000	IDA 2 – medium
Meeting room	36	800–1000	IDA 2 – medium
Retail shop	30	800–1000	IDA 2 – medium
Restaurant	36	800–1000	IDA 2 – medium
Warehouse hall	36	1000–1400	IDA 3 – moderate
WC	—	1000–1400	IDA 3 – moderate
Changing room/ showers	—	1000–1400	IDA 3 – moderate
Classroom	25	800–1000	IDA 2 – medium

Implementation

- If the measured CO_2 values are above the default values, the airflow must be increased (to improve the air quality).
- If the measured CO_2 values are below the default values, the airflow can be reduced (to save energy).

Example of calculation: default values for outside air supply

- Office with 10 people:
  10 pers. x 36 m^3/h person = 360 m^3/h
- Set the CO_2 control to constant regulation at 1000 ppm.
- For CO_2 controllers with a hysteresis: switch the ventilation on at 1000 ppm and switch it off at 800 ppm.
- With dynamic CO_2 controllers that can map a setpoint ramp, set the frequency converter so that the airflow increases continuously from 800 ppm, and 100 percent of the airflow is delivered at 1200 ppm.

Dry air in winter

Before you set up an energy-intensive air humidifier, check whether the airflow for the room can be reduced.

Additional information

- "Room usage data for energy and building technology", SIA fact sheet 2024, www.sia.ch
- Indoor air quality (IDA value), see standard EN 13779

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11.2021

Reduce the airflow in large spaces that are not in use

In many restaurants, auditoriums and multi-purpose halls, the ventilation setting is too intensive outside of usage times. Also, excessive airflows are often encountered in rooms where smoking has taken place in the past.

Action

Adjust the ventilation airflows to the effective requirements.

Requirement

It must be possible to control the airflow fan with a frequency converter, a step switch or an EC (electronically commutated) motor.

If the airflow is halved, the energy consumed by the ventilation decreases by 80 percent

What to do

1. Record the initial situation

- Determine the airflow setting (supply and exhaust air). These values should be recorded in the commissioning record for the ventilation system. If the data is missing, a ventilation specialist can determine the volume flows.
- Note the current supply and exhaust airflows in the logbook (plant journal).

2. Analyse the demand and measure the air quality

(See page 2 for procedure and details)

3. Adapt airflows

- Compare the measured values with the default values (see page 2) and adapt the airflow if necessary.
- In case of major variances in occupancy, adapt the airflows to the specific occupancy situation.

4. Note, observe and correct

- Enter the newly adjusted airflows and setting values (frequency and speed) in the logbook.
- Observe the users (are there any complaints?) and correct the set values if necessary.

Costs – effort

- Your own labour (measurements, settings, updating the logbook): approx. 4 hours
- Air quality measurement (CO_2, air humidity): CHF 200 per measuring point

Please note!

- If additional requirements are defined for the rooms (overpressure/underpressure), they must be taken into account.
- The supply and exhaust airflows must be coordinated with each other.

Additional explanations

Analyse the demand

Ascertain whether the ventilation system – as originally planned – is still needed today, or whether it can be shut down completely (especially outside of usage times). If you are not sure about this, proceed as follows:

- Switch the ventilation system off completely.
- Using a time switch, turn the system on only at times when it is definitely required.
- Monitor the air quality with a CO_2 meter (note that the increase in CO_2 is delayed).
- Monitor the indoor air temperature in rooms with high, fluctuating occupancy (e.g. multi-purpose halls).
- Adapt the times on the time switch.

Setting the volume flow

The volume flow (m^3/h) is the airflow that is fed to the room. Depending on the ventilation system, either fresh air only or fresh air with a percentage of recirculated air is blown in. The volume flow can be changed as follows:

- Change the levels on the relevant fans (e.g. levels 1 and 2)
- Adjust the speed of fans with a frequency converter (e.g. continuous control based on limit values such as CO_2 and temperature)
- Adjust the speed on fans with EC (electronically commutated) motors (using the integrated motor electronics)
- Have the fan's transmission ratio adjusted by a ventilation specialist (change the pulley)
- Cycle the system (switch on/off) over the operating times for an average/moderate volume flow
- Reduce the required volume flow with intermittent operation so that the airflow per person is only 30 m^3/h
- Define seasonal operating times or levels

Consider replacing the motor

For large ventilation systems that operate for more than 4000 hours per year, it is often worth replacing an inefficient motor that is 15 to 20 years old with a new and efficient model.

Highly fluctuating occupancy

If there are major fluctuations in occupancy, the airflow must be adapted to the effective demand insofar as possible.

- If the room is unused throughout the day (works holidays, semester breaks, rest days, etc.), switch the ventilation off entirely and "flush" it for 30 minutes once a day.
- For "medium" occupancy, operate the ventilation system at level I (or airflow of 50 percent) instead of level II (100 percent).
- For "high" occupancy, let the ventilation system run at a higher level (level 2 or airflow of 100 percent).

How to determine the default values

The theoretically required volume flow can be calculated on the basis of the number of occupants, the usage or the room type. The following table provides guidance values for the calculation:

Room type	Outside air volume flow (m^3/h/person)	Targeted CO_2 concentration (ppm)	Requirements for room air (category)
Open-plan office	36	800–1000	IDA 2 – medium
Meeting room	36	800–1000	IDA 2 – medium
Retail shop	30	800–1000	IDA 2 – medium
Restaurant	36	800–1000	IDA 2 – medium
Warehouse hall	36	1000–1400	IDA 3 – moderate
Classroom	25	800–1000	IDA 2 – medium

Example of calculation: default values for outside air supply

- Restaurant with 100 persons
  100 persons x 36 m^3/h person = 3600 m^3/h
- Set the CO_2 control to constant regulation at 1000 ppm.
- For CO_2 controllers with a hysteresis: switch the ventilation on at 1000 ppm and switch it off at 800 ppm.
- With dynamic CO_2 controllers that can map a setpoint ramp, set the frequency converter so that the airflow increases continuously from 800 ppm, and 100 percent of the airflow is delivered at 1200 ppm.

Additional information

- "Room usage data for energy and building technology", SIA fact sheet 2024 (charge payable)
- The IDA (indoor air) values are described in standard EN 13779.

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11.2021

Fine-tune the heat recovery unit to achieve top performance

If the heat recovery unit (HRU) is not working properly, you won't see or feel anything because the supply air is reheated by the heating coil even without an HRU. Nevertheless, valuable room heat is lost.

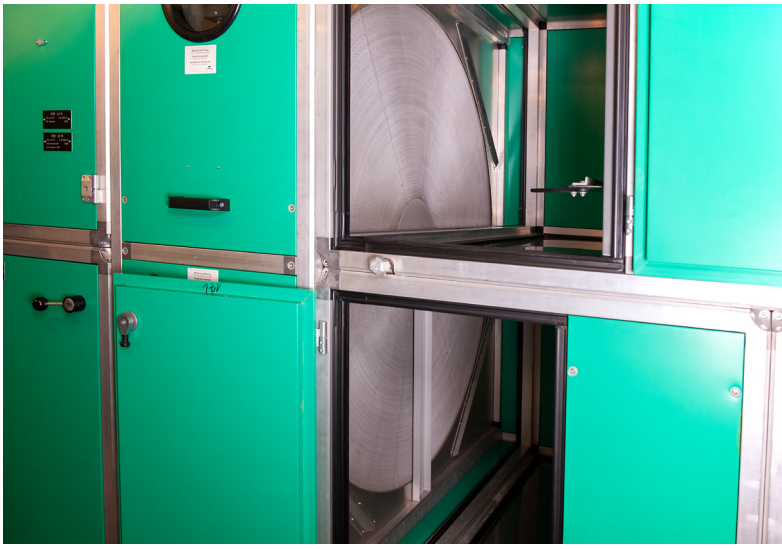
Action
Check and optimise the efficiency of the heat recovery unit to reduce energy consumption.

Requirement
You have a supply and exhaust air system with a heat recovery unit (HRU).

An HRU that functions correctly will save energy costs of up to CHF 3800 per year[1]

What to do
It is best to check the heat recovery unit (HRU) on a day when there is no solar radiation, with an outside temperature of between 5 °C and 10 °C. The ventilation system must be operating for this purpose.

- Read the temperatures on the air duct thermometers. The heating coil and the cooling coil must not be operating when you do this because they influence the temperatures.
- Calculate the quota of recovered waste heat (see page 2)
- Optimise heat recovery (see page 2)
- Check the heat recovery unit regularly



Costs – effort
Your own labour: approx. 4 hours

Please note!
- The supply and exhaust airflows must be coordinated with each other.
- Check the accuracy of the thermometers. Even small deviations (such as 1 °C) can severely falsify the measurement. In case of doubt, rent or purchase an accurate digital thermometer and use it to record the temperatures.

1 Applies to a medium-sized ventilation system that operates for 10 hours, 5 days a week and delivers 5000 cubic metres of air per hour.

Additional explanations

Air temperatures

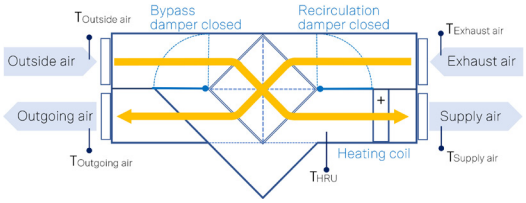
The various air temperatures can be read directly from the thermometers in the air ducts. So that you can determine the efficiency of the HRU:

- If bypass dampers (which bypass the heat exchanger) are present, they must be fully closed;
- If recirculation dampers are present, they must also be closed (with this type of bypass, a certain proportion of the exhaust air is fed directly back into the room).

Otherwise, not all of the air will be fed through the heat recovery unit and it will be impossible to determine its efficiency correctly.

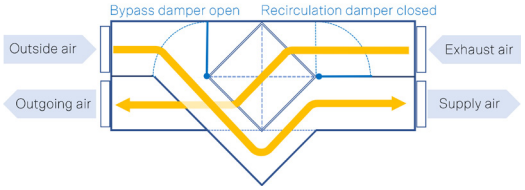
A: Bypass and recirculation dampers closed

HRU operation with closed bypass and recirculation damper.



B: Bypass damper open and recirculation dampers closed

If the bypass damper is open, the heat recovery unit is bypassed (this is ideal in summer, for example, when the exhaust air temperature is higher than the outside temperature).



C: Bypass damper closed and recirculation dampers open

If the recirculation damper is open, part or all of the exhaust air is fed back directly into the supply air (in winter, for example, in order to maintain the air humidity). In this case, the HRU's capacity is not fully utilised (no illustration).

Calculate the recovered waste heat

You can calculate the efficiency of the HRU on the basis of the various air temperatures. Percentages of waste heat recovered by a good HRU with a:

- Cross-flow heat exchanger: 65 percent
- Composite circulation system: 60 percent
- Rotary heat exchanger: 75 percent

$T_{Outside\ air}$ = 3 °C; T_{HRU} = 16 °C; $T_{Exhaust\ air}$ = 21 °C

Efficiency = (T_{HRU} – $T_{Outside\ air}$) / ($T_{Exhaust\ air}$ – $T_{Outside\ air}$)
= (16 °C – 3 °C) / (21 °C – 3 °C)
= 13 °C / 18 °C
= 0,72 resp. 72 percent

Instead of T_{HRU}, you can also measure the temperature of the supply air (TSupply air). But in this case, you must make sure that neither the heating coil nor the air cooler are operating.

Optimise heat recovery

You can take these actions to optimise heat recovery:

- On the monobloc ventilation control or the building management system, set the HRU so that 100 percent of the exhaust air is routed via the heat exchanger.
- Make sure that the exhaust air is not routed past the HRU through the bypass. Check whether the bypass dampers are working and that they close tightly.
- Check whether the recirculation dampers are closing tightly.
- Check whether the icing protection is functioning correctly. Rule of thumb: a plate heat exchanger starts to ice up when the plate temperature falls below 0 °C.
- Check whether the heat exchanger is soiled and have it cleaned or clean it yourself if necessary. In this case, follow the manufacturer's instructions.
- If you do not find the cause of the fault, have the system inspected by a specialist.

Additional information

See the manufacturer's maintenance instructions.

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11.2021

Comfortable, energy-saving air humidity at the workplace

Air in workplaces must be neither too dry nor too humid. Correct indoor air humidity settings always pay off, because a great deal of energy is required to humidify the air.

Action
Determine the actual air humidity in the room and select the optimal humidification setting for the supply air on the ventilation system.

Requirement
You have a ventilation system that humidifies the supply air and ensures a pleasant indoor climate.

What to do
Check the relative indoor air humidity on a cool and dry winter day when the outside temperature is below 4 °C. This will enable you to choose the optimum setting values for the supply air. The ventilation system must be in operation when you do this.
- Measure the air humidity in the rooms that you ventilate.
- If the relative air humidity (RH) is significantly above 35%, check the temperature and humidity in the exhaust air duct. If the relative air humidity is also too high here, adjust the humidification values on the ventilation unit so that the rooms are controlled to a relative air humidity of 30%.
- Check the relative air humidity in your rooms on the next day, and also one week after the optimisation. Correct the value on the ventilation unit as necessary.

Costs – effort
- A simple uncalibrated hygrometer costs between CHF 30 and CHF 40. A calibrated hygrometer is available from specialist trade outlets at prices starting from CHF 250.
- You will require about two to four hours of labour, depending on the number of rooms and ventilation units.
- If the air is humidified by an additional 5%, the energy required for humidification will increase by 40% to 80%.

Please note
- In physiological terms, an optimum relative air humidity value in winter is 30% or more. The value may also fall below this level for short periods.
- In cases where active humidification is unavoidable, the value should not exceed 45% RH. Also, please note the SIA recommendations.

Additional explanations

Example: conference centre

To take one example: optimisation of air humidity is particularly effective in a conference centre. If the supply air for the plenary hall is humidified at a constant value of 40% RH, a reduction to 30% RH can reduce the annual energy consumption for humidification by 42'000 kWh. This is because considerable volumes of air are humidified – in this example, the ventilation system conveys 50'000 m^3 of air per hour, and operates for 800 hours each year.

Use humidification for cooling

Consult a ventilation specialist to check whether adiabatic cooling by evaporation is possible and suitable with the existing humidification system. In this case, the supply air can be cooled down by several degrees Celsius with the humidification equipment, instead of using a mechanical cooler. This "evaporative cooling" is particularly suitable in the transition period, when the required cooling effect can be achieved with slightly increased air humidity.

Dry air at very low temperatures

If some ventilated areas are very dry during winter when outside temperatures are below 0 °C, you can manage to improve this by reducing the flow of supply air. Monitor the room air humidity constantly, and reduce the outdoor air flow by up to 50%. It may be necessary to adapt the control (with a second control circuit) for this purpose. Discuss the situation with your ventilation specialist.

Do you have individual rooms with high indoor air humidity requirements?

If there is a need for high indoor air humidity (e.g. 50% RH) in two or three of your rooms, it is not worth increasing the humidification of the whole supply air via the central ventilation unit.

Instead, increase the air humidity in these rooms with plants (e.g. papyrus), water features (water walls, fountains, climate fountains, etc.) or with an efficient room air humidifier (evaporator).

Swimming pools and wellness pools/spas

In swimming pools and wellness pools/spas, the air in the facility must be constantly dehumidified during opening hours to provide a pleasant climate. But at night, when there are no guests in the pool or spa, the air humidity there can be increased to save energy.

The air humidity can be raised until condensation water forms on the component with the worst thermal behaviour (glass surfaces, corners, or poorly insulated steel beams). If you discover condensation water on these building components, the air humidity is too high and the set point must be lowered. Experience shows that in buildings where the "worst" building component has a U-value of 1,2 W/m^2K, the air humidity can be increased to as much as 65% at night without condensation forming.

Additional information

- Operational optimisation for energy efficiency – operating buildings more efficiently: reference book, 2021
- Building technology – integral system planning, reference book, 2022
- Energy efficiency in fitness and wellness facilities: the easy way to reduce your energy costs
  Information sheet 05: Ventilation
- Standard conditions of use for energy and building technology, Fact sheet 2024, SIA, 2015
- Air humidification
  Fact sheet for specialists in the ventilation industry, architecture and building services, SwissEnergy, 2016

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09/2022

Change now to LED: better light and significantly lower electricity costs

The widely used fluorescent lamps are disappearing from the market. Modern LED lamps and intelligent control systems are an optimal replacement. Replacing your lighting pays for itself financially in a short time, and the quality of light improves immediately.

The fluorescent lamp (FL lamp or "neon tube") has become obsolete – since autumn 2023, it may neither be manufactured nor imported throughout Europe. This means that several million lamps in Switzerland will have to be replaced with LED technology in the next few years.

Modern LED lighting with intelligent control reduces electricity costs by up to 95 percent.

A unique opportunity for better light

LED lamps have a much better light quality than fluorescent lamps. Pleasant light at the workplace is an often underestimated prerequisite for productive work.

Intelligent control with LED

LED lamps are easier to control than conventional lamps and make much better use of the potential for efficient, economical operation. The light adjusts to your needs at all times. As a result, intelligent dimming in combination with daylight enables sophisticated and astonishingly economical lighting solutions.

Content **Page**

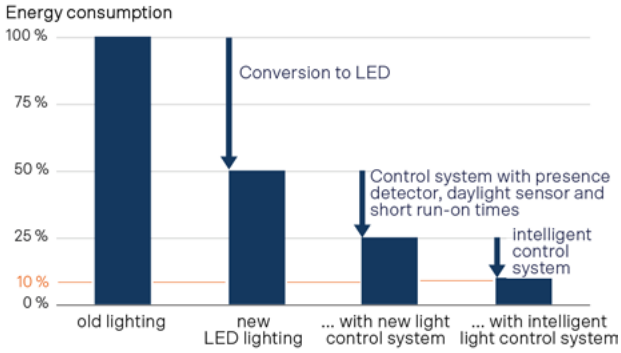
The replacement of the old lighting is a stroke of good luck

There is no reason to mourn fluorescent lamps, because the "ban" (see box) presents great opportunities. New lighting brings better light and has been proven to increase work performance in companies. In addition, electricity costs can be reduced by 50 to 95 percent. The investment usually pays for itself in two to ten years.

There is great potential for savings in the lighting system as a whole

A new lighting system not only includes the conversion to LED technology. Intelligent lighting control is just as important as the new lamps. It is also essential that the new lighting is perfectly adjusted by a specialist during commissioning.

This is how you reduce energy consumption:



FL lamp, fluorescent lamp, "neon tube" or energy-saving lamp?

In common usage, these terms are often used synonymously; the correct technical term is fluorescent lamp. They are available in different designs: tubular, ring-shaped or rod-shaped, with a plug-in or screw socket.

How to successfully change over to LED

In any lighting project, no matter how large or small, a structured approach is the key to success.

1. **Inventory**
   Analyse your needs and the existing lighting.
2. **Finding solutions**
   Decide how you want to approach the replacement (see page 16, point 7).
3. **Request offers**
   Compare the offers.
4. **Apply for funding**
   Clarify whether the contractor will handle processing (see page 16).
5. **Place an order**
   Confirm the order in writing (simple contract for work).
6. **Realisation**
   Supervise the work.
7. **Adjustment of the lighting**
   Have the control system properly adjusted before acceptance.
8. **Acceptance**
   Check that the finished installation fully complies with the order description.

Why are FL lamps "disappearing"?

The classic incandescent lamp was already banned in 2009 because of its poor energy efficiency. Since September 2023, this also applies to most halogen lamps. Fluorescent lamps, on the other hand, contain hazardous substances such as mercury. As a result, they may no longer be manufactured and imported in Europe and Switzerland as of August 2023. After that, the stocks will be sold off. All installed and purchased lamps may still be used. However, experts assume that the FL lamps will be sold out quickly and that the change to LED technology is inevitable.

First analyse the existing lighting

For existing lighting installations, the requirements have often changed since installation. Renovation is a good time to update expectations for light. A good analysis includes the following five steps:

Step 1: Call in a specialist

A specialist (e.g. for electrical installation, lighting design, lamp supply) advises you on technical and design issues and coordinates the implementation of the project. Ask about successful LED reference projects.

Step 2: Inventory

The specialist describes the lighting for each room. At least the following points must be documented for all lighting fixtures and rooms:

- ☐ **Room use** and changes since the installation of the lighting.
- ☐ **Illuminance:** Compare the measured values of the current lighting with the prescribed values (see page 10).
- ☐ **Uniformity of illuminance:** For this purpose, the floor plan of the room is sketched, the lighting fixtures are drawn in and – depending on the size of the room – the illuminance is measured and documented at several points.
- ☐ **Positioning of the lighting fixtures:** Are they still located where they are most useful?
- ☐ **Control system:** Description of the control system and its elements (e.g. dimmable lighting fixtures) as well as the installed networking options (DALI bus, EIB/KNX, Bluetooth, etc.).
- ☐ **Condition of the lighting fixtures:** Are the materials made of high-quality metal or are they yellowed and brittle elements made of plastic? Can trays and reflectors be cleaned or diffusers replaced?

Step 3: Requirements and expectations

Record the initial situation of the project in writing. Describe your requirements (appearance, functionality, etc.) and the corresponding basic conditions (foreseeable changes in use, budget range, etc.).

Step 4: Suggested procedure

The specialist develops a concept on how the lighting can be renovated. The concept must comply with the current standards (see pages 8 and 10).

Step 5: Evaluation and implementation of decision

Discuss the results of the inventory and the suggested procedure with the expert. In which rooms is which solution most suitable? (More on this on the next page.) Why is this approach recommended?

Different approaches lead to attractive, efficient light

There are four solutions for modernising lighting – from converting individual lighting fixtures to replacing the entire lighting system. Solution D (retrofit with LED tube) is usually only considered during a transitional period.

On the basis of the analysis, your specialist will recommend which solutions are ideal for the respective rooms and for your situation.

Solution A
Convert existing lighting fixture to LED
- with existing high-quality housings in good condition
- best solution for valuable individual lighting fixtures
- resource-saving
(see page 5)

Solution B
Replace FL lighting fixture with identical LED lighting fixture
- often the simplest solution for downlights, track systems and beam lighting fixtures
- minimal installation effort
(see page 6)

Solution C
Replacement with newly planned LED lighting
- best choice if the old installation no longer meets the current requirements
- optimal use of all advantages of modern LED technology and new control options
- highest potential for energy savings, reducing electricity costs by up to 95 percent
(see page 7)

Solution D
Replacement of the FL lamp with an LED tube
- suitable in rooms with low visual comfort requirements
- fast, cost-effective retrofitting
- often not in accordance with the requirements of the Labour Code; in such cases, only a suitable option as a short-term transitional solution
(see page 15, box in right column)

Convert well-preserved and high-quality lighting fixtures

Requirements

Conversion to LED is suitable for lighting systems with several identical lighting fixtures in good condition. In addition, lighting fixtures for which manufacturers offer conversion kits are suitable for this purpose. Retrofitting is also worthwhile for high-quality lighting fixtures (individual fixtures worthy of protection). In any case, have the installation effort carefully checked. Often the reflectors can be reused or replaced with so-called diffusers. If necessary, a preliminary inspection can provide clarity on lighting quality and costs.

Converting a lighting fixture conserves natural resources because components are reused.

Who converts the lighting fixture?

Some manufacturers offer the conversion of their lighting fixtures. In addition, there are innovative lighting and electrical companies that have many years of experience with conversions.

Don't forget the lighting control system

When the lighting fixture is converted, a modern control system can often also be retrofitted. The time-consuming additional installation of control wires is no longer necessary. Today, there are inexpensive control elements with which the lighting fixtures can also be operated wirelessly (Bluetooth).

LED conversion kits

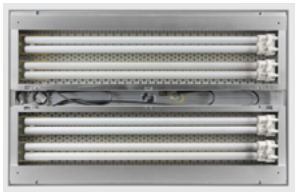
With an LED conversion kit, for example, existing linear lighting fixtures or light channels can be easily converted. The old tubes, sockets and ballast are removed. Then the new power supply unit and the LED conversion kit are clicked into place. LED conversion kits are also available with intelligent control (DALI, Zigbee).

Example of lecture hall lobby at Swiss Federal Institute of Technology (ETH) in Zurich

The design lighting fixtures were equipped with modern LED lamps. The classic design of the original lighting fixtures has been preserved.

Example of free-standing lighting fixtures in offices

In thousands of offices, there are free-standing lighting fixtures with compact fluorescent lamps. The existing lighting fixture head can often be replaced by a head with an LED module with little installation effort.



before

after

Replacement with an identical LED lighting fixture

Requirements

With all standardised lighting systems, replacement with an identical lighting fixture (1:1 replacement) is possible. Typical examples are so-called downlights, strip lights, louvre lighting fixtures, track systems or batten lighting fixtures. Their standardised installation dimensions make them easy to replace.

When is a replacement a good idea?

In a 1:1 replacement, for example, a downlight installed in the ceiling is dismantled and replaced with an identical LED downlight. This kind of replacement is possible in many situations. It is simple and requires no or minimal planning effort.

Consider other solutions

With the 1:1 replacement of the lighting fixtures, you maintain the status quo of your lighting situation. Therefore, first check whether the existing lighting concept still meets your requirements in terms of

- illuminance
- uniformity, and
- glare

Otherwise, consider a different solution. The new lighting must meet your current requirements and the standards (labour law, safety, etc.).

Always include the control system in your thinking

Even with a 1:1 replacement, you need to think about the lighting control system. If necessary, a bus cable can be retrofitted; however, this would result in additional costs. Instead, consider a suitable wireless system with Bluetooth.

Examples of standardised lighting systems

Strip light

Recessed lighting fixture

Track system

Downlight

Hanging lighting fixture

Plan new lighting and benefit from outstanding light

Requirements

If the analysis shows that replacing the entire lighting system is the best solution, professional planning is imperative. This offers a unique opportunity to obtain high-quality lighting with low energy and operating costs. The investment costs usually pay for themselves in two to ten years. Then you benefit from the low energy costs of your new lighting.

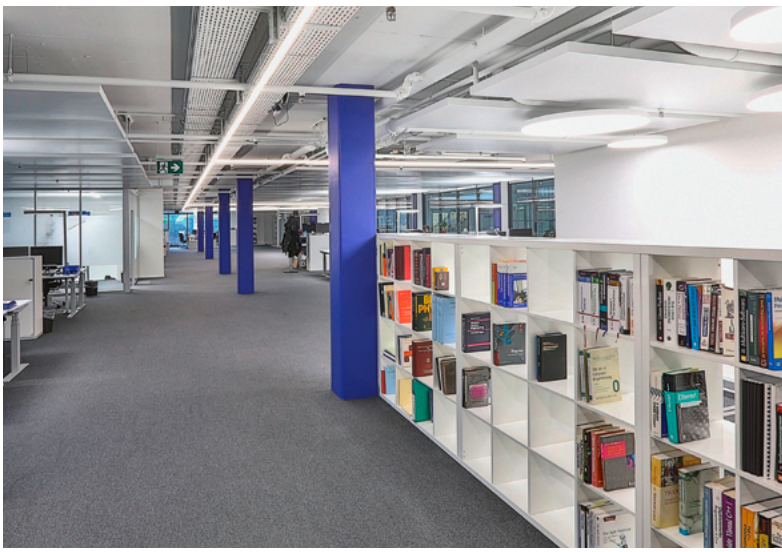
How to go about it the right way

Have a specialist prepare a proposal for replacing the entire lighting system with LED lighting (including the control system, commissioning with adjustment, etc.). The new lighting system must take into account the results of your stocktaking and the basic conditions (see page 3). Give the bidders the checklist for offers (see page 8) with the check points which must be taken into account. This will provide you with better quality offers that you can compare more easily.

What does a new lighting system cost?

The cost of a new lighting system depends on various individual factors and can vary greatly. On the basis of the evaluation of various funding measures and the experience of experts, the following benchmarks result for different uses:

Use	Typical costs CHF/m²	Note
Office	90–120	Elegant solution up to CHF 250/m²
School	90–140	
Sales area	80–160	
Production	60–120	
Warehouse/ storage hall	40–50	
Parking garage	20–40	Retrofit approx. CHF 10/m²



What to do on a tight budget

Whether for a school building or office building, you can also carry out the lighting replacement in stages. Dismantle the lighting fixtures in one or more rooms and install modern LED lighting with an intelligent control system. Keep the operational FL tubes as replacements for the tubes in the other rooms. Replace the next rooms in the following year until the entire building has been converted to LED lighting.

Rent your new lighting system

There are offers from various lighting fixture suppliers, utilities and contracting companies with which the new lighting installation can be rented or purchased via a financing model (contracting) with monthly instalments.

Supplement to the offer

Our services for good lighting

Our offer corresponds to the recommendations of SwissEnergy. We confirm that we have taken the following points into account in our offer:

☐ **Energy efficiency**
The lighting offered fulfils the
- ☐ limit value according to SIA 378/4
- ☐ maximum value for funding by ProKilowatt
- ☐ target value according to SIA 378/4

☐ **Lighting quality**
The lighting offered meets the requirements of the SN EN 12464-1 standard "Light and lighting – Lighting for workplaces" with regard to
- ☐ the minimum illuminance
- ☐ the maximum glare (UGR value)
- ☐ compliance with the uniformity of illuminance (U_o value)
- ☐ the minimum requirements for colour rendering (R_a value)

(see page 10 in the fact sheet[1])

☐ **Light calculation for the room**
The lighting has been designed with a simulation (with Relux, Dialux, etc.). Identical rooms are only simulated once.

☐ **Central key data**
There is a data sheet for each lighting fixture in the offer. This includes at least the following information: system output (incl. control gear) in W, luminous efficiency in lm/W, colour rendering R_a value, dimensions in mm and information on the interchangeability of components.

☐ **Dimmable lighting fixtures**
The lighting fixtures offered are dimmable.

☐ **Control system**
The offer provides for an intelligent control system for the lighting (see page 9 in the fact sheet[1]).

☐ **Commissioning**
The lighting solution is commissioned professionally (see page 10 in the fact sheet[1]).

☐ **Adjustment**
The lighting solution is adjusted professionally (see page 10 in the fact sheet[1]). In addition, the costs for the adjustment are shown separately in the offer.

☐ **Funding**
The offer shows which subsidy programmes are eligible, how high the expected financial contributions are and whether the provider applies for the subsidies on behalf of the client.

☐ **A contract partner**
The quotation shall indicate who is the contract partner for the entire lighting installation. The responsible person takes responsibility for the entire project (see page 16 in the fact sheet[1]).

☐ **Repairability**
The offer shows whether and to what extent the lighting fixtures can be repaired, how the availability of spare parts is guaranteed and where they can be obtained.

☐ **Guarantees**
The offer provides information about the guarantee period of the components.

Date

Signature

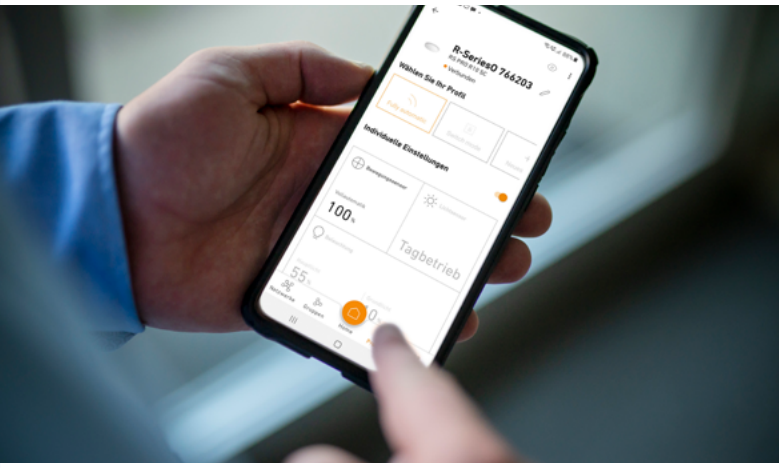
Company

Submit this page to the company making the offer. Ask them to tick the applicable items ☐ and include the signed sheet with the offer.

×

[1] Fact sheet "Change to LED now: better light and significantly lower electricity costs", SwissEnergy 2023.

The intelligent control system makes the difference



Enormous progress has been made with LED technology in terms of lighting control and sensor technology. Today, LED lighting can be dimmed easily, cost-effectively and without loss. Good LED lighting fixtures are equipped with an intelligent control system[1] and can be controlled via a bus system or wirelessly (Bluetooth).

If you save on the control system, you lose comfort and money!

The intelligent lighting control system performs several functions:

- **Daylight control and dimmers** mix only as muchartificial light with the existing natural lightas is actually needed.
- The **sensor** (motion detector, presence detector, etc.) switches the light on only where it is needed.
- If the person leaves the occupied zone, the sensor detects this and switches the light off after the set **run-on time**.
- The **swarm control** directs the light through the room with the person (see page 12).

Integration in bus systems

If a higher-level control system or a bus system (DALI, KNX, etc.) is available, the new lighting should be integrated in it if possible. If the lighting fixtures are converted (see solution A) or replaced 1:1 (see solution B), dimmable LED drivers must be retrofitted.

Adjustment via Bluetooth

The wireless control (Bluetooth) does not require any additional cables. Bluetooth-capable lighting fixtures can be easily networked to form groups. They can be conveniently controlled with an app or a button. This kind of wireless control with Bluetooth is a cost-effective solution worth considering, especially for a 1:1 replacement or for converted lighting fixtures.

Daylight-dependent control

In rooms with daylight, savings of 30 percent and more can be achieved with a control system that always adjusts the proportion of artificial light to daylight. The use of daylight sensors is worthwhile not only in industrial buildings with shed roofs (see example on page 13) and in schools and offices with large window areas, but also in many other places, such as stairwells with windows (see example on page 14).

Dimming is mandatory

In order to be able to regulate the lighting, the LED lighting fixtures must be equipped with adjustable or dimmable ballasts and a control option (app, button). At modern manufacturers, dimmable LED lighting fixtures hardly cost more than non-dimmable lighting fixtures. Dimming also significantly increases the life of the lighting fixture.

[1] With intelligent lighting, the individual lighting fixtures are networked with each other. Each lighting fixture has its own light sensor that adjusts brightness and lighting time to the effective need.

Correctly adjusted lighting saves up to an additional 30 percent

Commissioning and professional adjustment

By professionally adjusting the lighting system, you can save up to 30 percent on electricity costs, provided you use dimmable lighting fixtures. That adds up to a considerable amount over the years. Obligate your contractor or specialist to correctly adjust all parameters of the regulation after commissioning.

This includes the following tasks:

- Measure and correctly adjust the illuminance. Often the installed illuminance is over-dimensioned due to excessively high standard "safety margins" and in many cases can be reduced by 30 percent or more.
- Adjust the threshold value of the daylight sensor to the individual situation.
- Set the run-on times of the presence detectors as short as possible. With LED lighting, the run-on times can be reduced to one minute in accordance with the SIA recommendation.

Readjustment after three to five years

Over the years, the illuminance decreases (soiling, ageing of the components). With a good control system, it can be easily readjusted if necessary.

Have the costs for readjustment shown separately in the offer as an option. This will give you an indication of the user-friendliness of the new lighting system. High costs are an indicator that readjustment of the control system offered is expensive. Low costs show that readjustment is easily possible.

Some important lighting characteristics for orientation[1]

Use	Reference No. SN EN 12464-1	Illuminance factor Lux	Glare (UGR value)	Colour rendering index (R_a value)	Uniformity (U_0 value)
Individual, group, open-plan office	34.2	500	≤ 19	≥ 80	≥ 0.6
Meeting room	34.5.1	500	≤ 19	≥ 80	≥ 0.6
Classroom	44.1	500	≤ 19	≥ 80	≥ 0.6
Sales (food, clothes, shoes, etc.)	35.1	300	≤ 22	≥ 80	≥ 0.4
Restaurant (self-serve)	37.4	200	≤ 22	≥ 80	≥ 0.4
Assembly work (rough work)	19.5.1	300	≤ 25	≥ 80	≥ 0.6
Assembly work (medium-fine work)	19.5.2	500	≤ 22	≥ 80	≥ 0.6
Warehouse (open)	13.4	200	≤ 25	≥ 80	≥ 0.4
WC, bath, shower, wardrobe	10.4	200	≤ 25	≥ 80	≥ 0.4
Traffic areas	9.1	100	≤ 28	≥ 40	≥ 0.4
Stairwell	9.2	100	≤ 25	≥ 40	≥ 0.4
Parking spaces (not publicly accessible)	42.2	75	--	≥ 40	≥ 0.2

[1] The exact requirements are described in SN EN 12464-1 "Light and lighting - Lighting of workplaces - Part 1: Indoor workplaces". The values of SN EN 12464-1 must be complied with – in accordance with the Labour Code – at the workplace (see also Guidance to Ordinance 3 to the Labour Code, Section 2, Art. 15 Lighting).

With careful acceptance you will obtain better results

Insist on a professional handover

After commissioning and adjustment, carry out an acceptance test of the lighting system.

During acceptance, make sure that all the services offered have been provided. In addition, complete installation documentation must be provided. In it, the planning values and the actual adjustment values must be documented for each room:

- ☐ Lighting fixture (manufacturer, designation)
- ☐ Number of lighting fixtures
- ☐ Illuminance
- ☐ System output incl. operating devices
- ☐ Light colour
- ☐ Glare
- ☐ Rated output of the lighting fixtures
- ☐ Adjusted maximum operating output of the lighting fixture
- ☐ Control system (type, function)
- ☐ Supply address for spare parts
- ☐ Safety certificate (SINA)
- ☐ Guarantee services

etc.

Check whether all points of the offer checklist (see page 8) are fulfilled. Create an acceptance report in which all fulfilled services as well as any defects are recorded in writing. The report must be signed at the time of acceptance (see Sample Acceptance Report for Lighting).

Sample
Acceptance Report
for Lighting

Check before expiration of the guarantee period

Check the lighting installation for defects three to four months before the guarantee period expires and report them to the contractor in writing.

Swarm intelligence ensures safety and good lighting

Underground car parks and multi-storey car parks are usually inhospitable places where many people feel uncomfortable. For this reason, the lighting is often operated as continuous lighting "at full blast".

In cases like these, the installation of an intelligent LED lighting system with so-called swarm intelligence is recommended. Each lighting fixture has a sensor (motion or presence sensor). The lighting fixtures are networked and share sensor information with the respective neighbouring lighting fixtures.

The light moves with the person

When a person enters the underground car park, two to four lighting fixtures in the immediate vicinity switch to full light (100 percent illuminance). The surrounding lighting fixtures detect the direction of movement and switch on an orientation light (approx. 10 percent of full light) in this area. This provides security and enables spatial orientation.

"Our tenants feel much safer and energy costs have dropped significantly."

Sereina Keller, Team Leader Property Management, HGW Heimstätten-Genossenschaft Winterthur

In this way, the light moves through the room with the person. In the vicinity of the person there is full light, and in the wider area a pleasant orientation light. In the remaining areas of the underground car park, the light remains greatly reduced.

Measurements in Winterthur and Zurich have shown that intelligent LED lighting with swarm intelligence reduces electricity consumption by more than 90 percent.[1] These types of systems are suitable not only for underground car parks and multi-storey car parks, but in principle for all extensive, irregularly used spaces such as stairwells, corridors, archives and warehouses.

Video
Swarm lighting in practice

[1] See the HGW Heimstätten-Genossenschaft Winterthur project (refurbishment of two underground car parks) and the Heuried residential settlement project in Zurich.

Well-lit workplaces with a high proportion of daylight

In the industrial halls of SIG allCap AG in Neuhausen, the old strip lights (two-lamp lighting fixtures) were replaced by efficient LED batten lighting fixtures. At the same time, the lighting system, which previously operated with full light (100 percent) all day, was equipped with a daylight sensor system.

Illuminance deficits eliminated

One of the reasons for switching to LED was the unsatisfactory lighting situation in the workplace area. Working at the high-precision machines that produce closures for cardboard packaging (e.g. for beverages) requires a great deal of light. Measurements showed that the old FL tubes only provided 300 lux instead of the required 500 lux. The new LED lighting provides significantly higher illuminance. Even though the new lighting fixtures are 50percent more efficient than the old FL tubes, electricity costs can "only" be reduced by 10 percent because the number of lighting fixtures was increased in favour of better illumination. In return, the requirements of the Labour Code regarding uniformity are now also complied with.

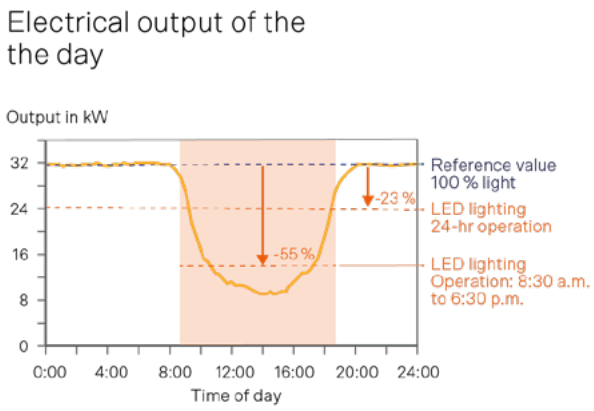
The daylight sensor system reduces the energy costs of the lighting by 10,000 Swiss francs per year.

Daylight sensor technology makes the difference

The two industrial halls have a shed roof ("sawtooth roof" with skylights) that provides the halls with light during the day. With the help of daylight sensors, the LED lighting fixtures automatically adjust the illuminance to the ambient light during three-shift operation (24 hours x 365 days). This reduces energy consumption by an additional 23percent. The annual energy costs for lighting can therefore be reduced by an impressive 10,000 Swiss francs.

Particularly effective during the day

The evaluation of the project shows that with daylight sensors in industrial halls with shed roofs in single-shift operation, it is even possible to achieve savings of up to 55 percent.



Functional and more convenient – with 90 percent less energy

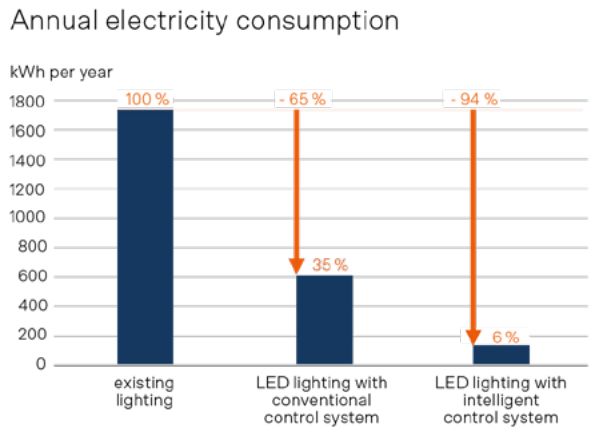
Like many other buildings in Switzerland, the common traffic areas of the "Rütihof, Zu-rich-Höngg" housing development of the ASIG housing cooperative were previously illuminated with compact fluorescent lamps. The lighting on the basement floors was controlled with a motion detector, and with a twilight switch on the floors with daylight. The 22 lighting fixtures installed had a combined connected load of 560 watts. As a result, the illuminance (without daylight) reached an average of around 30 lux.

Replacement with intelligent LED lighting fixtures

The lighting was replaced with intelligent, net-worked LED lighting fixtures with integrated daylight and presence sensors. The connected load of the lighting was reduced to 200 watts. At the same time, it was possible to increase the average illuminance to around 80 lux.

Clever control

The individual lighting fixtures can be adjusted with an app on a mobile phone. In addition, the lighting installation has swarm intelligence. The integrated presence sensors detect people and automatically switch on sufficient light. Thanks to the networking of the lighting fixtures and sensors via the Blue-tooth wireless standard, people are accompanied safely and with good light through the stairwells.



The right lighting solution for any situation

Our lighting fixtures are more than 20 years old
For old, heavily worn lighting systems with yellowed and brittle plastic parts, replacing the entire lighting system is the best solution. This way you can also benefit from an intelligent control system. The investments pay off quickly thanks to reduced energy, maintenance and servicing costs.

Our building will be completely renovated in the next two to five years
A retrofit solution with LED tubes can cover the time until the lighting is replaced. (see box on right).

Our lighting is new, but equipped with old technology
Look into converting the lighting fixtures so that the new lighting fixtures do not have to be disposed of. This way you save valuable resources.

We have old surface-mounted lighting fixtures in the stairwell of our block of flats
A conversion or retrofit solution is hardly worthwhile here. Take the opportunity to replace all the lighting in the stairwell with modern LED lighting fixtures with an intelligent control system (see pages 9 and 14).

How can I check whether the project is economically viable?
A good offer compares the characteristic values of the old with those of the new lighting. This will give you a breakdown of the economic viability of most funding programmes and the amount of funding available for your project.

Solution D
Replacement of the FL lamp with an LED tube

In rooms with low visual comfort requirements (e.g. archives, ancillary rooms in companies as well as cellars, laundry rooms and single garages in private environments), FL lamps can be replaced with LED tubes. These fit into the old sockets or bases (retrofit).

Important: The Labour Code sets quality requirements for lighting at the workplace. LED tubes often do not meet these criteria and are therefore not suitable as a replacement in these cases. At most, they can be used to cover a temporary situation.

When replacing the FL lamp with an LED tube, the following points must be observed:
- FL lighting fixtures with conventional ballasts (CBs) can be easily converted with an LED tube and the LED starter supplied (see fact sheet below).
- For lighting fixtures with electronic ballasts (EBs), EB compatibility lists are available from the lamp manufacturers. With the help of these lists, you or your electrical specialist can determine which LED tubes are suitable for the installed EB lighting fixtures.

Fact sheet
Replace old lighting fixtures with LED tubes

The seven most expensive mistakes in lighting replacement

1. Requirements not analysed
The analysis of the existing lighting fixtures and the future lighting requirements are the basis of successful lighting replacement.

2. Saving on the control system
With an intelligent control system, you can tap into an additional 40 percent savings potential in electricity costs. Modern control systems are also cost-effective.

3. Cheapest solution chosen
The solution with the lowest investment costs can become expensive over the years. Therefore, be sure to consider the total cost per year.

4. Operation without adjustment
Every lighting installation must be carefully adjusted to avoid consuming electricity unnecessarily.

5. Poor lighting quality
Good lighting quality at the workplace increases productivity and reduces the risk of accidents. The Labour Code also stipulates lighting quality requirements that you must comply with.

6. Funding applied for too late
If you are counting on funding: it must always be applied for before the order is placed, otherwise you will miss out on this valuable contribution to your project.

7. Unclear responsibilities
Give one company overall responsibility for the project. Clear responsibilities are needed between the electrician and the lighting fixture suppliers in order to avoid expensive interface problems.

Photo sources:
ASIG Wohngenossenschaft/Ralph Hut: Page 14
HS Technics AG: Page 3, 4, 5 top, 5 bottom, 7
Nevalux AG: Page 6 top, 11
SIG allCap AG: Page 13 top
shutterstock: Front page
Steinel GmbH: Page 9
Zumtobel Licht AG: Page 6 bottom, 13 bottom
zweiweg gmbh: Page 11

Illustrations:
zweiweg gmbh, Page 2, 14

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Where can I obtain funding?

There are a variety of attractive funding programmes that direct subsidies towards replacing an existing lighting installation with efficient LED lighting. In recent years, the funding programmes have been steadily improved and the effort and complexity of applying for the funds have been significantly reduced.
Important: The subsidies must be applied for and approved before the order is placed. Subsequently – if the lighting has already been replaced – subsidies can no longer be applied for.

Information on the funding programmes
(Energiefranken)

07/2023

Set daylight sensors, motion and presence sensors correctly

The lighting control is equipped with a motion and presence sensor or a daylight sensor – but the light does not switch off, even though sufficient daylight is available and nobody is present in the room.

Action

Set the daylight setpoint and the after-run time so that the lighting switches off as soon as the incoming daylight is sufficient or as soon as nobody is present in the room.

Requirement

The lighting control must have a motion sensor, presence sensor and/or daylight sensor.

What to do

1. Set the daylight setpoint correctly

- Measure the illumination level with a lux meter and compare it to the recommended values (see overleaf).
- Gradually reduce the lux setpoint on the sensor (A) until the lighting switches off at the recommended value.

2. Set the correct after-run time for the presence sensor

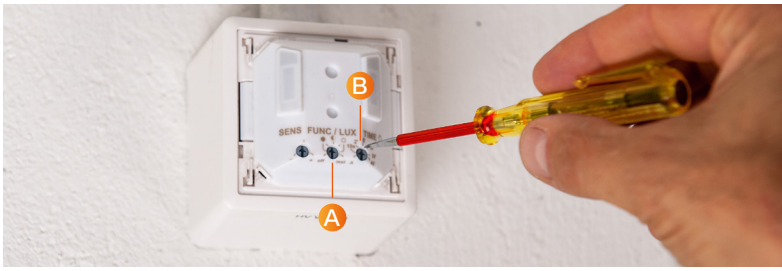
Set the time on the sensor (B) (for recommended after-run times, see overleaf).

3. Pay attention to the coverage area

The motion or presence sensor should be set so that people are detected within the desired radius. The switched luminaire must not be located within the sensor‘s coverage area. The sensor should be at least 1 metre away from the object – i.e. the person to be detected.

4. Observe and correct

Pay attention to complaints and correct the set values as necessary.



Costs – effort

- A lux meter measures the illumination level. Simple meters cost about CHF 100 from mail-order electronics vendors.
- Your own labour per room: 10 to 20 minutes.

Please note!

- Record every adjustment of the setpoints in writing.
- If there is no scaling on the controllers, a photograph of the setting is helpful; it is best to print and store this photograph.
- Safety: in areas where there is a risk of falling (e.g. staircases, ramps), the daylight setpoint should only be reduced to an extent that ensures compliance with the recommended illumination levels (100 to 150 lux).
- Install presence sensors in protected locations with unimpeded visibility. The coverage area is limited by objects such as glass partitions and furnishings.
- The installation height influences the sensor’s coverage area. As the installation height increases, the range also increases but the sensitivity of detection decreases sharply.

Additional explanations

Recommended illumination levels

Depending on the room and how it is used, different illumination levels are recommended to create optimal working and usage conditions. The illumination level is measured in lux.

Room, usage type	Illumination level, lux
Offices, administration	
Reception, simple work	300
Office, PC, workstations, meeting rooms	500
Office, storage/filing areas	300
Hospitals, care homes	
Waiting rooms and common rooms	200
Service rooms	500
Treatment rooms, operating theatres	1000
Patients' rooms, recovery rooms	100
Patients' rooms, lighting for reading	300
Therapy rooms, gymnastics and massage rooms	300
Medicinal baths	300
Laboratories and sterilisation rooms	500

Room, usage type	Illumination level, lux
Catering outlets, canteen/refectory	
Kitchen, utility/laundry room, linen room	500
Restaurant, dining rooms	200
Self-service facility, office	500
Buffet, counter	300
Cold stores	100
Schools	
Classrooms	500
Lecture halls, laboratory rooms, art/drawing rooms, workshops	500
Teaching rooms, law office, other offices, reading positions	500
Libraries, bookcases	200
Libraries, reading areas	300
Gymnasiums/sports halls, lighting class III	200–300

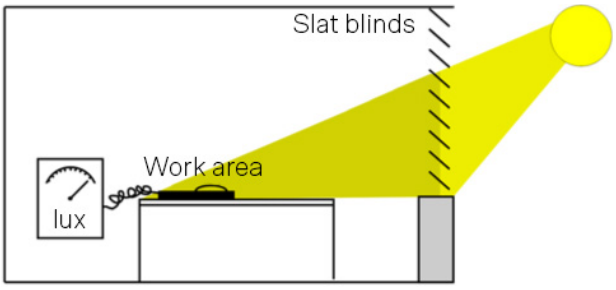
Recommended after-run times

The after-run time eliminates the annoyance of the lamp being switched on and off, and protects the lighting equipment.

- FL lamps, energy-saving lamps: 5 to 10 minutes
- LED lamps: 2 to 5 minutes

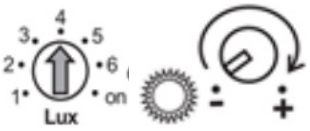
Determine the illumination level

With slat blinds, you can allow enough daylight to enter on a fine day by adjusting the slats so the appropriate illumination level is present at the workplace. Measure this with the lux meter.



Explanations of the symbols

Every manufacturer uses a slightly different designation for the potentiometers used to set the values. The most frequent symbols are:



Daylight sensor: can be identified by the word “lux” or the sun symbol.

After-run time: can be identified by the word TIME or the clock symbol.

Additional information

- Technical book: “Light in the home – energy-efficient lighting”, www.faktor.ch
- Efficient lighting for small businesses

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11.2021

Replace old fluorescent lamps with modern LED tubes

Older lighting systems with fluorescent (FL) lamps require intensive maintenance. It is worth checking whether FL lamps can be replaced with LED tubes, especially in rooms used for long periods.

Action
Replace existing fluorescent lamps (T8 and T5) with modern LED tubes (retrofit).

Requirement
This action is especially suitable for rooms with long usage periods (over 3000 hours per year) and low requirements for visual comfort (garages, warehouses, circulation/traffic areas, production halls).

Replacing the fluorescent lamps achieves energy savings of 40 to 60 percent on lighting.

What to do
1. Determine the lamp type
The lamp type (T8 (G13) or T5) can be identified from the lamp base. Check the holder (socket), which is usually marked with this information.

2. Determine the type of ballast
- T8 lamps with a starter are equipped with a conventional ballast (CB) or a low-loss ballast (LLB).
- All T5 lamps and T8 lamps without a starter are equipped with an electronic ballast (EB).

3. Choose the right LED tube
Make sure that the LED tube you choose is suitable for the type of ballast that is installed (conventional/low-loss ballast or electronic ballast).

4. Convert part of the installation for a test
- Convert part of the lighting system (see overleaf).
- Test the new LED tubes over a small area for three to six months to examine whether the tubes prove worthwhile in practice (illumination and light quality).

5. Convert the rest of the lighting
After a successful test, you can convert the entire lighting system.

Costs – effort
- Price of LED tubes: CHF 15 to CHF 50 per tube

Your own labour:
- Systems with a conventional/low-loss ballast: 5 to 10 minutes (per luminaire)
- Systems with an electronic ballast: 15 to 20 minutes (it is mandatory for an electrician to carry out this work)

Please note!
- For the retrofit solution with LED tubes, the light quality depends on the specific product in each case. This should first be assessed by performing a test, especially for large systems. If the LED tube does not meet the requirements for light distribution and glare, it is advisable to replace the entire luminaire. This, however, necessitates larger investments. If the light colour is not adequate or if the LED tube flickers, the solution may be a different product.
- For lighting equipment that is difficult to access (e.g. in high-ceilinged halls), the use of LED tubes is particularly worthwhile because fewer lamp changes are required.

Additional explanations

Replacement for systems with conventional/ low-loss ballasts

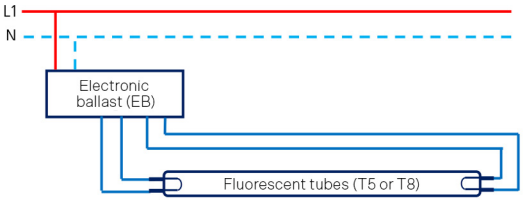
- Turn the power off
- Remove the fluorescent tubes
- Remove the old starter from the holder
- Place the new LED starter in the holder
- Insert the LED tube
- Turn the power back on

Replacement for systems with electronic ballasts

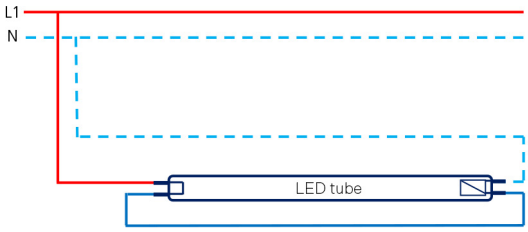
Important: it is mandatory for a specialist (electrician) to carry out this conversion.

- Remove the electronic ballast, or bridge it
- Insert the LED tube

Before



After



Assessing LED tubes

- Good products come with a manufacturer's warranty for at least three years or 30'000 operating hours.
- Energy efficiency is determined by the luminous efficacy. This should be at least 120 lm/W (calculation based on luminous flux and electrical power).
- Pay attention to the radiation angle of the LED tubes because they can cause glare.
- Design types: clear glass LED tubes are more efficient but they tend to cause more glare. Frosted glass tubes are not quite as efficient but they cause less glare.
- Choose a light colour that is appropriate for the type of usage.
  - Warm white: 2700 Kelvin – welcoming, comfortable
  - Neutral white: 4000 Kelvin – functional
  - Cool white: 6500 Kelvin – cool, technical

What does this mean: L80B10C5 = 30'000h?

The "L-B-C" value specifies the LED's lifetime (here: 30'000 hours) in more detail.

L80 = after the 30'000 hours, the lamp still delivers at least 80 percent of the original luminous flux (80–100 as a typical value)

B10 = less than 10 percent of the lamps fail due to reduced luminous flux (0–10 as a typical value)

C5 = less than 5 percent of the lamps fail completely during their lifetime of 30'000 hours (1–5 as a typical value)

Pay attention to the inrush current

The LED tube's electronics generate a short-lived inrush current peak. This is no problem for one single luminaire. However, if an entire lighting system is converted, the inrush current must be taken into account. Good-quality LED tubes often have a low inrush current. The problem can also be mitigated with an inrush current limiter or a zero-cross switch. It may be necessary to replace the existing circuit breakers and install additional relays. This makes it possible to switch the lighting on gradually. It is worth engaging an electrical installer for this purpose.

Additional information

- Technical book: "Light in the home – energy-efficient lighting", www.faktor.ch
- Efficient lighting for small businesses

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11.2021

Adjust the illumination level to actual requirements

How can you optimise a room's lighting – and at the same time save at least 30 per cent on electricity costs? Here are some suggestions and tips to shed some light on the matter.

Action

Adjust the light level to the room's utilisation. Install presence and motion sensors where applicable.

Requirement

Only dimmable lighting systems can be adjusted to the specific use of the room. Other ways of lowering consumption, such as switching off individual light fixtures, are in most cases a poor compromise.

Needs-based lighting adapted to usage will cut electricity costs by at least 30 per cent.

What to do

1. Determine the illumination level (setpoint value as per SN EN 12464-1)
Use the table to determine the right illumination level for the room.

2. Determine the electrical power (setpoint)
Using the SIA table, determine the recommended (maximum) electrical output (W/m^2) for the room.

3. Measure the current illumination level (actual value)
Measure the actual illumination level (lux) in the room. You need a lux meter to do this.

4. Calculate the current electrical power (actual value)
Based on the existing lighting (light fixtures, light sources), calculate the installed electrical power per square metre.

5. Compare the actual values to the setpoint values
If there is a discrepancy between the actual values and the setpoint values, adjust the lighting.

Costs – effort

Work involved: approx. 1 hour per room

Material costs:
- Lux meter, approx. CHF 100
- Motion sensor, approx. CHF 50 to CHF 100
- Presence sensor, approx. CHF 100 to CHF 150

Please note!

- If you replaced an old lighting system (e.g. FL tubes) with a new system (LED), a 1:1 replacement may result in the room being overlit because the luminous efficacy of LEDs is greater.
- Retrofittable light sources with integrated presence and daylight sensors are available; depending on the preset, these can dim the light or turn it off entirely.

Additional explanations

Determine the specific power

You can determine the currently installed electrical power per square metre (W/m²) as follows:

1. Calculate the total power of the lighting

- Count the light fixtures in the room.
- Determine the electrical power per light fixture. This includes the light sources (bulbs, etc.) and control devices.
- You can now calculate the total power of the lighting. Example: Six light fixtures, each with two 36W FL tubes = 432W
  Plus six 12W control devices = 504 W

2. Determine the room's area

Example: 8m (length) x 6m (width) = 48m²

3. Calculate the specific power (W/m²)

Example: 504 W/48m² = 10,5 W/m²

Assess the situation

A: The room is overlit.

The illumination level (lux) is currently too high.

- Dim the lights. If this is not possible, check whether other light sources can be used. However, this usually also changes the light distribution.

B: The room is underlit.

The illumination level (lux) is currently too low.

- Use more efficient light sources (e.g. LED instead of FL tubes). However, this usually also changes the light distribution. Consider adding to or replacing the lighting system.

C: The room is lit inefficiently.

The illumination level is correct but the specific power of the lighting (W/m²) is too high.

- Consider switching to a more efficient light source or replacing the light fixtures.
- Optimise the lighting control by using presence, motion or daylight sensors to ensure that the lighting operates only when people are present or when insufficient natural light is available.

Assessment

Standard SIA 387/4:2023: Electricity demand for lighting provides the basic principles for assessing the specific power consumption. This standard contains the maximum permitted specific power (in W/m²) and the value for an optimised lighting system.

Room usage	Illumination level, lux	Specific power, W/m²	Full-load hours, h/a
Reception	300	3,3–5,1	3150–4100
Individual/shared office	500	6,2–9,7	350–1400
Open-plan office	500	4,9–7,6	1100–1950
Classroom	500	5,5–8,6	400–1300
Lecture hall	500	4,9–7,6	850–1700
Gymnasium, sports hall	200–300	5,6–8,8	1100–2250
Locker room	200	2,8–4,4	150–850
Sales area	300	7,5–11,6	4000
Patient room	100	3,4–5,3	800–1550
Hospital ward	300	6,2–9,7	4550–5750
Laboratory	500	6,4–9,9	400–1350
Kitchen	500	6,2–9,7	1700–2500
Restaurant	not specified	2,9–4,6	1600–2650
Canteen	200	2,6–4,1	900–1500
Circulation area	100	1,8–2,7	250–1400
Staircase	100	1,8–2,7	250–1400
Carpark (not public)	75	0,6–0,7	480–1600
Warehouse/storage area	200–300	2,9–3,9	2000–4000

The full-load hours listed in the table can be taken as the basis for assessing the period for which the lighting is turned on.

Additional information

- Standard SIA 387/4: 2023, Electricity in buildings – Lighting: Calculation and requirements
- SN EN 12464-1 Light and lighting – Lighting of work places – Part 1: Indoor work places
- Technical book (de): Licht im Haus – Energieeffiziente Beleuchtung, www.faktor.ch
- Efficient lighting for small businesses

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11.2021

Consistently close up refrigeration and freezer units at night

Refrigeration units should be consistently “closed up” outside of opening hours. Night blinds, covers or glass doors are suitable for this purpose. The cold then stays inside the units and you avoid unwanted temperature fluctuations.

Action

Make sure that all refrigeration and freezer units such as display cabinets, shelves, free-standing and promotional showcases are closed off from the room outside of opening hours (at night and at weekends).

Requirement

You have freezer or refrigeration cabinets that are open to the room at night.

When refrigeration units are closed up, they consume up to 30 percent less energy.

What to do

1. Analyse the situation

- Check which refrigeration units do not have night covers, sliding glass covers, night blinds or glass doors.
- Check whether existing covers and roller blinds are in working order. Have faulty components repaired, or replace them.

2. Check out retrofitting

- Ask your supplier for an offer to retrofit the refrigeration units with covers, (automatic) roller blinds or glass doors.
- Procure the appropriate covers.

3. Employee training

- Train your employees. Show them how to operate covers and roller blinds. Define who is responsible for closing them up and where the covers are stored during the day.
- Monitor daily implementation of these measures. If there are problems, clarify the causes (technical, logistical, time related) and attempt to eliminate them.

Costs – effort

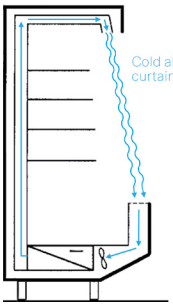
- Your own labour: approx. ½ to 1 day to inspect all covers and doors, including obtaining an offer (one time only)
- Night blinds for “plus” cooling cabinets cost approx. CHF 300 to 500 per metre.
- Covers for refrigerated counters cost approx. CHF 150 per metre.
- Additional labour for covering with manual roller blinds and covers: depending on the size of the shop, 5 to 10 minutes per day

Please note!

- It always pays off to cover freezer units consistently.
- On freezer units, specifically check that the glass doors close tightly, and replace the seals if necessary.
- Glass doors always pay off when installing new refrigerated shelving units, or when replacing such units.

Additional explanations

Maintain the cold air curtain

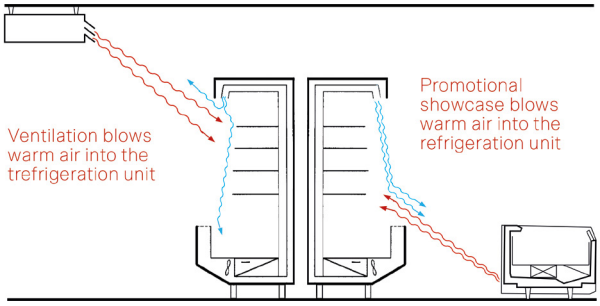


Source: RAVEL

If the cold air curtain of refrigeration units is disrupted, the temperature can no longer be guaranteed. This can negatively impact product quality and operating costs. It is therefore essential to keep ventilation slits free of goods and price signage. Also, the maximum stacking height in the unit must not be exceeded. It is best to apply marks showing how high products can be stacked.

Avoid deviations from the required temperatures

Position mobile refrigeration units so that the warm air they give out is not blown into other refrigeration units. Also, units should not be placed in draughts, near air outlets of the ventilation system or in direct sunlight.



Source: RAVEL

Switch off refrigeration units

After the shop closes, clear out and switch off all refrigeration units where you store products supplied on a daily basis. Ideally, refrigeration units of this sort should be equipped with a time switch. Programme the timer so that the units are switched on two hours before your business starts operating. Then, when you start work, you can immediately place the day's fresh new products in the units.

Correct storage temperatures for products

Make sure that the products for sorting into the units are already cooled. Refrigeration units (special refrigerated display cases) are not suitable for cooling products down to the desired temperature. If a product is warm when it is placed in the refrigerated shelving unit, the temperature in the unit can no longer be guaranteed. Product quality may suffer as a result. Energy consumption and costs are also increased unnecessarily. For some products such as raw milk, pasteurised milk, cream cheese, cream, butter, meat and fish, the Federal Ordinance on Foodstuffs and Utility Articles stipulates maximum temperatures for storage and sale.

The following temperatures may be taken as guidance values:

Open fresh products
(in staffed refrigerated counters)
- Meat, sale: max. 5 °C
- Meat, storage: max. 2 °C
- Fish and similar items: max. 2 °C (storage and sale)

Packaged products (self-service)
- The maximum storage temperature is usually printed on the product package by the manufacturer.

Deep-frozen products
- Max. –18 °C (storage and sale)

Retrofitting glass doors on refrigeration units

Retrofitting glass doors on existing refrigeration units (for milk, meat, fish, cheese, etc.) reduces their energy consumption by up to 30 percent. This corresponds to annual savings on energy costs of CHF 200 to 300 per metre. The costs of retrofitting are CHF 700 to 1500 per continuous metre of refrigerated shelving.

Additional information

- Refrigeration and freezer units – 7 energy-saving tips for employees
- Successfully retrofitting glass doors on "plus" cooling cabinets
- Federal Ordinance on Foodstuffs and Utility Articles (SR 817.02)

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11.2021

“De-ice” cold stores and deep-freeze rooms, and keep them dry

Is ice forming on the surfaces of your deep-freeze room or on the evaporator? Are you noticing excessive condensation forming in your cold store? Both these phenomena are signs of too much moisture in the room. In both cases, reduce the moisture input.

Action

Check cold stores and deep-freeze rooms regularly to see if ice and/or water have formed, remove deposits and minimise the moisture input.

Requirement

You have a deep-freeze room or cold store (solid construction), or a cold-store cell or deep-freeze cell (room-in-room).

Reducing the temperature in a cold store or deep-freeze room by one degree C increases the energy costs by three percent!

What to do

1. Inspect the room

Check regularly to see whether any condensation or ice has formed in the cold store or deep-freeze room, or on the evaporator. Find the cause:

- Does the door seal tightly? Check the seals and the closing mechanism.
- Is there any unwanted input of moisture – from open or warm products, for example?
- Can the cold air circulate freely in the room? (See overleaf)

2. Rectify faults

- Replace faulty seals and closing mechanisms. Wipe up the condensation and remove the ice by defrosting or using a deep-freeze cleaner.
- Find out what refrigeration temperature the products require and adjust the temperature to the actual requirements. When the type of usage changes, the old (lower) setpoint is often retained even though the temperature could be increased for the new usage.

Source: SSP Kälteplaner

Costs – effort

- A door sealing profile costs between CHF 10 and 20 per metre.
- Replacing the door-closing mechanism costs CHF 200 to 500. Replacing the entire door costs approx. CHF 2000.
- Your own labour: approx. ½ day. If large areas of the room are iced up and everything needs to be defrosted and cleaned: up to 2 days’ labour.

Please note!

- Special deep-freeze cleaners are available for deep-freeze cells and deep-freeze rooms. They are applied to the layer of ice; they penetrate the ice and loosen it. Then you can detach and remove it, and dry the liquid condensation. After you remove the ice, you must look for the cause (why did the ice form?) and eliminate it.
- In cold stores accessed by pallet rollers or forklifts, there is an increased risk of damage to door seals. If necessary, bollards can be installed to protect the doors against damage.

Additional explanations

Check the cooler's location

For reasons of energy efficiency, coolers installed over the cold store door should be relocated away from the door area – it is best to position them opposite the door. This can also prevent condensation from forming in the future. In deep-freeze cells, the coolers should be fitted with an automatic defrost device that is set correctly.

Correct temperatures

For some products such as raw milk, pasteurised milk, cream cheese, cream, butter, meat and fish, the Federal Ordinance on Foodstuffs and Utility Articles stipulates maximum temperatures for storage and sale. The following temperatures may be taken as guidance values:

Open fresh products
(in staffed refrigerated counters)

- Meat, sale: max. 5 °C
- Meat, storage: max. 2 °C
- Fish and similar items: max. 2 °C (storage and sale)

Packaged products (self-service)

The maximum storage temperature is usually printed on the product package by the manufacturer.

Deep-frozen products

Max. –18 °C (storage and sale)

Unused cold stores, refrigeration cells and deep-freeze cells: switch them off!

Cold stores and refrigerated cells that are not required or in use can be switched off. The same applies to deep-freeze cells (room-in-room system) that can also be defrosted without problems.

Unused deep-freeze rooms: increase the temperature

Deep-freeze rooms (of solid construction) that are not required or in use should never be switched off completely. Instead, increase the temperature of the deep-freeze room from –18 °C to –5 °C. This will already save you about 35 percent of the electricity consumption. Please note: If the cooling is switched off entirely, frozen water can thaw out in the walls of the deep-freeze room and accumulate in the floor. When the cooling is switched back on, the water freezes and there is a risk that the floor will rise and compromise the statics.

Employee training

Employees should note these points:

- Don't leave doors open for long periods
- Consistently switch lights off
- Adhere to maximum stacking heights
- Do not place warm products into refrigerated storage
- Automatic door-closing systems must not be propped open manually (with a wedge, for example)
- Report defects (ice formation, condensation water, faulty seals, etc.)

(Also see: 7 energy-saving tips for employees)

Ensure air circulation

Organise the stacking of products in the cold store so that the cold air can circulate freely. Make sure that products stored in corners and on the upper level are cooled adequately. To achieve this, adhere consistently to maximum stacking heights in the cold store. The air outlet from the evaporator/air cooler must never be obstructed or built over.

Lighting in cold stores and deep-freeze rooms

Equip cold stores and deep-freeze rooms with LED lighting and motion sensors. LED lighting radiates far less heat and thus does not heat up the cold store unnecessarily. With motion sensors, you can ensure that the lights are on only when someone is present in the cold store – and switching off the lights is never forgotten. Alternatively, the lighting can be connected to the door opening mechanism. Make sure that the LED lamps and motion sensors used in deep-freeze rooms are suitable for the low temperatures.

Additional information

- Cold stores and deep-freeze rooms, 7 energy-saving tips for employees
- Guideline on optimising refrigeration systems (with instructions on cleaning heat exchangers)
- Federal Ordinance on Foodstuffs and Utility Articles (817.02)

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11.2021

Compressed air leaks cost you precious money

Even well-maintained compressed air systems are not free of leaks. They must be inspected every year and the leaks must be rectified – but at the latest when the compressor leaps into action for no reason during the night even though the plant is inactive.

Action

Inspect the compressed air pipe system for leaks every year. Mark the leaks and seal as many of them as possible.

Requirement

You have a compressed air system that operates for at least 4 hours every day.

In a poorly maintained compressed air network, an average of 40 percent of the air is lost through leaks.

What to do

1. Track down the leaks

- Use the leak detector to systematically check pipes, connections and plants. You will find most leaks in the last few metres near the end consumers.
- Note down the leaks you find on a leak record (there is a model in the "4-step check to optimise a compressed air system" – see the additional information).

2. Repair the leaks

Rectify the leaks you have identified:

- If possible, seal the leaks immediately – for example, by tightening up screwed connections.
- Use a coloured label to identify leaks that cannot be rectified immediately. Note the location of the leak and the materials needed to rectify it.
- Order the materials needed to rectify the leak.
- Once the materials have been delivered, seal the leaks.

3. Repeat annually

The compressed air system must be checked for leaks at yearly intervals – because it's inevitable that new leaks will occur all the time.

Costs – effort

- Your own labour (detecting and sealing leaks):
  - 1 working day per year for small systems
  - 3 to 5 working days per year for larger systems
- Foam leak detector: approx. CHF 20 per can
- Leak detector: purchase prices start at CHF 1000
- Leak detector, weekly rental price: approx. CHF 150

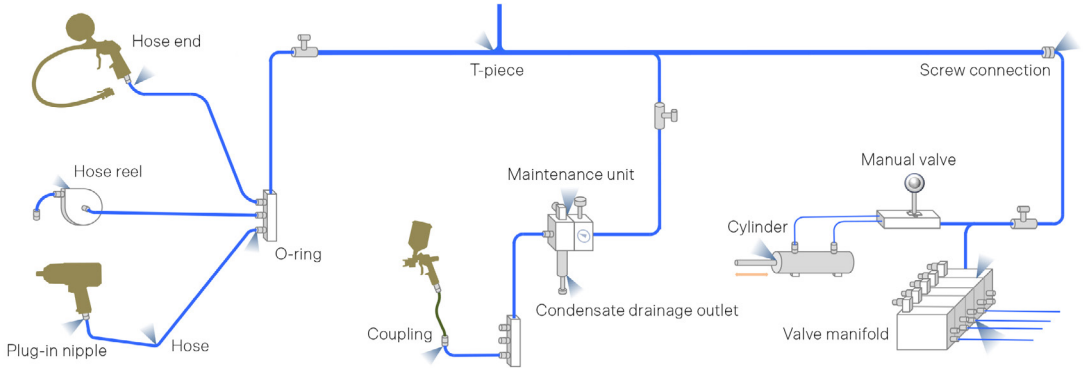
Please note!

- Compressed air is a form of energy that can be used universally – but it is also a very expensive form of energy.
- It is difficult to quantify the size of leaks because the volume of the noise created by escaping air (leakage noise) does not indicate how much air is being lost.
- It is hardly worth sealing leaks that are only active for a few minutes each day. Examples of these include faulty seals on a door opening cylinder when the door is open if the door is only open for 15 minutes per day.

Additional explanations

Typical weak points

Most leaks are found near the end consumers. It is particularly worthwhile to examine these areas:



100 percent airtight is not always possible

It is only possible to eliminate all leaks in a very small minority of cases. There are often leakage points that would take too much time and effort to seal. So: focus on those leaks that can be sealed easily and quickly.

How to rectify leaks

- Tighten loose screwed connections and replace old screwed connections that are not airtight
- Fit O-rings correctly and replace damaged O-rings
- Replace leaky couplings and plug-in nipples
- Tighten or replace hose clips
- Shorten or replace brittle hoses that are not airtight
- Have non-airtight valves and cylinders repaired or replaced by a specialist
- If components such as maintenance units have leaks, replace the seals or replace the entire unit

Hemp-sealed connections

Pipe systems with hemp-sealed pipe connections have an exceptionally high risk of leaks. The hemp paste dries out over time so the pipe connections are no longer airtight. Leaking screwed connections can often be sealed with Teflon tape. Check whether it would pay off to gradually replace the hemp-sealed pipe system with a modern, gap-free distribution system.

How to locate leaks

Use your ears: If all consumers are switched off, you will already be able to hear many leaks with your own ears. This method does not work in facilities with noise emissions that operate on a 24/7 basis – and it is also unsuitable for leaks outside of the audible range.

With foam leak detector: A simple method for small systems with few end consumers. The foam leak detector also allows detection of the exact location of leaks that could not be tracked down accurately with other methods (e.g. on valve manifolds).

With an ultrasonic measuring instrument: This method allows leaks to be located while production continues to operate, even in production halls with very high noise emissions. Models with a horn are better at focusing the sound waves, and they can locate leaks more accurately. A headset also makes it possible to hear the leaks. In addition, there are models that quantify the leakage rate in litres/minute and can even calculate the annual savings potential in francs.

Additional information

- Guideline on optimising compressed air: actions and tips
- 4-step check to optimise a compressed air system
- Efficient compressed air platform

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11.2021

Shut the compressed air system down at night – and cut costs while you sleep

If production ceases at night or during weekends and there is no need to supply any equipment that consumes compressed air, the entire compressed air system can be switched off during these periods.

Action

An automatic start-up device automatically switches the compressed air system off and back on again. When switching off, it disconnects the pipe network with an electrically operated ball valve, so it turns off the compressor as well as the dryer.

Requirement

Ensure that the system does not have to supply any continuous consumers of compressed air such as ventilation flaps, diaphragm pumps, slide valves for water pipes, etc.

What to do

- From your supplier, obtain an automatic start-up device and a ball valve that can be controlled with a time switch. The ball valve should have the same dimensions as the outlet of the compressed air line downstream of the dryer.
- Install the ball valve downstream of the dryer.
- Ask the supplier to install the automatic start-up device.
- Programme the automatic start-up device so that it:
  - Switches off the pipe network, the compressor and the dryer with the ball valve 30 minutes after the end of operation (closing time).
  - Switches on the dryer and compressor 30 minutes before the start of operation (opening time). The ball valve is set to open slowly 15 minutes later.

Costs – outlay

- Depending on the size of the plant, installation of an automatic start-up device with a ball valve costs between CHF 2000 and 3000.
- For large systems with many leaks, the amortisation period for your investment is 1 1/2 years. For small systems with few leaks, the amortisation period is somewhat longer.

Please note

- The control requires a manual switch that makes it easy to start operating the compressed air system outside the programmed operating times.
- Important: a slow-opening ball valve must be used. Solenoid valves open too quickly, so they are not suitable for switching entire systems or sub-systems off and on. This is because switching the equipment on quickly causes what are known as pressure shocks or surges; these can cause major damage (ripped filters, water in the compressed air network, etc.).

Additional explanations

Switching the compressed air system on and off manually

The compressed air system can also be switched off and back on manually. But be careful to avoid errors when switching on and off manually, because if the ball valve is wrenched open when switching on instead of being opened slowly, the system can be damaged. Filters can be torn, and water or oil can penetrate the pipe network and cause serious damage to the machines. Experience also shows that people repeatedly forget to switch off manually. The compressed air system continues to operate even though no compressed air consumers are active. You can find instructions on switching on and off manually in the Guideline on optimising compressed air from SwissEnergy.

Screw compressors

Screw compressors must still "run on" after they are switched off and for this reason, they must not be switched off via the network connection. They must be switched off and on via the internal control, and an expert should be engaged to make the connection correctly.

Automatic disconnection of compressed air distribution from the generator

95% of leaks are located in the compressed air network and on the equipment that consumes compressed air. The compressed air generating system (compressor, preparation unit) is only responsible for 5% of leaks. If the compressed air distribution network is disconnected from the generator, most of the losses will be avoided. A somewhat less costly variant is to disconnect the compressed air distribution network from the generator. In this case, only a time-controlled ball valve is installed downstream of the preparation unit. Since compressed air preparation continues to operate during the night, this solution saves somewhat less energy. The Guideline on optimising compressed air from SwissEnergy describes this variant in detail.

Additional information

- Short film: Energy efficiency in companies: switch off the compressed air

- Guideline on optimising compressed air, information for staff responsible for compressed air
- 4-step check to optimise a compressed air system, work instrument for staff responsible for compressed air
- Guidance on compressed air, boosting efficiency in compressed air systems

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Images: zweiweg

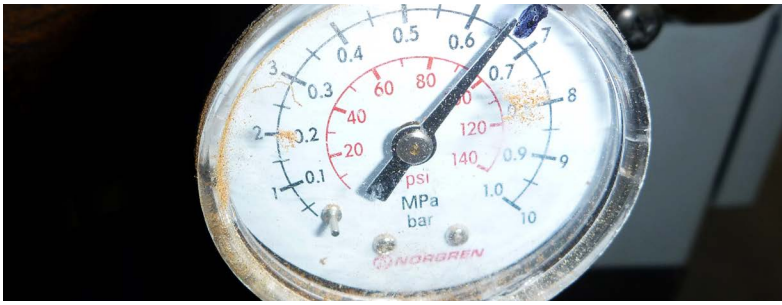
05.2023

Optimise the network pressure

If the pressure in the compressed air network is too high, the costs of compressed air and energy will rise with no additional benefit. Leakage losses will also increase, and tools that use compressed air will wear out faster.

Action
Adjust the network pressure on the compressor to the actual requirements.

Requirement
If the network pressure is below 5 bar, there is virtually no further scope for optimisation. For optimisation of the network pressure to be (financially) worthwhile, the pressure should be above 7 bar.



What to do
- Read the pressure setting on the compressor (e.g. 9 bar).
- Note the operating pressure for every application (machine, compressed air tool or systems).
- The main applications (90% of consumption) determine the nominal pressure required in the compressed air network (e.g. 6 bar). According to a rule of thumb, the pressure set on the compressor should be about 1 bar higher (e.g. 7 bar). This compensates for pressure losses in the lines.
- For applications that require higher pressure (9 bar), you can install a pressure intensifier or a booster-compressor. If the high pressure is required because the compressed air cylinders are too small, you could also replace them with larger ones.
- If large consumers require a lower pressure (e.g. 2 bar), consider a second compressed air system.

Costs – outlay
- If the pressure in the pipe system is 1 bar too high, the energy costs increase by 7% – without any additional benefit.

Please note
- Excessively high pressure on the tool shortens its lifetime as well as increasing wear and operating costs.
- Optimising the network pressure of complex systems with multiple compressors is a challenging task that requires experience. In case of doubt, it is advisable to call in an expert.
- Higher pressure means more leakage losses – so less pressure automatically reduces the leakage losses.
- Users often keep the pressure high because it gives them more reserve energy in the compressed air reservoir. If the reserve energy is required, another option is to install an additional larger reservoir so the pressure can be reduced.

Additional explanations

Connection accessories: minimise pressure losses

Consistently and continuously replace old hoses for equipment that requires high air consumption with modern PU (polyurethane) hoses. Follow these basic rules:

- Short, straight hoses
- Large inner diameters for hoses
- Only use spiral hoses for the final 3 to 5 metres in front of the work location
- No unused metres of hose on the hose reel
- Couplings compliant with the European standard, with diameters of 7.2 mm, instead of couplers that meet the Swiss standard with diameters of only 5.5 mm.

You can find more information in the Guideline on optimising compressed air from SwissEnergy.

Only use spiral hoses for the final metres.

High-pressure jet nozzles

If you use jet nozzles that require high pressure, you should check whether you could use a nozzle with a larger diameter and lower pressure.

Check whether the workshop needs to be integrated

Almost every workshop uses compressed air – for example, to paint or varnish workpieces, blow chips away at the lathe, pump up the company van's tyres, or blow off the filter mats from the ventilation system. To keep things simple, the workshop is often connected directly to the production department's existing compressed air network.

In practice, however, experts frequently encounter systems that are set only for the workshop's requirements, at a pressure of 6.3 bar (or more) – even though the production plant could operate at 4.9 bar without any problems. These 2 bars of "surplus" pressure increase energy costs by 14% – or even more if the leakage rate is high.

So, check whether the workshop really does need to be connected to the compressed air network. A small decentralised compressor is often a much more suitable solution for the workshop.

Additional information

- Short film: Energy efficiency in companies: maximum performance from pneumatic tools

- Guideline on optimising compressed air, information for staff responsible for compressed air
- 4-step check to optimise a compressed air system, work instrument for staff responsible for compressed air
- Guidance on compressed air, boosting efficiency in compressed air systems

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Images: Rolf Gloor/zweiweg

09/2022

Switch off sub-systems at night and weekends – and save costs

95% of leaks occur in the pipe network. This makes it worthwhile to disconnect sub-systems without permanent consumers from the compressed air network during the night and at weekends, when production ceases.

Action
Disconnect complete sub-systems and machines from the compressed air generator when no compressed air is required.

Requirement
You must make sure that no continuous consumers of compressed air (such as ventilation flaps, diaphragm pumps, slide valves for water pipes, etc.) are integrated into the sub-systems.

What to do
- In your compressed air distribution system, look for sub-systems that do not require compressed air after the end of operating hours (closing time).
- From your supplier, obtain a ball valve that can be controlled with a time switch. The ball valve should have the same dimensions as the compressed air pipe at the position where it is installed.
- Programme the time switch so that it closes the ball valve 30 minutes after the end of the operating period, and opens it again 30 minutes before operation restarts.

Costs – outlay
- Suppliers' prices for an electrical ball valve with a time switch start at CHF 350. The installation costs have to be added to this.
- The amortisation period for the investment depends on the size of the system and the number of leaks. Empirical values indicate that the investment pays for itself in about one year.

Please note
- If you intend to use this solution to disconnect the entire compressed air network, install the ball valve at the point where the compressed air line exits from the compressor chamber.
- Important: A slow-opening ball valve must be used. Solenoid valves are not suitable because they open too quickly. This causes what are known as pressure shocks or surges, which can cause major damage (ripped filters, water or oil in the pipe network).

Additional explanations

Disconnect machines with a solenoid valve from the compressed air network

Many machines operate with uncontrolled continuous consumers of compressed air, and they have leaks. They still consume compressed air when the machine is not operating.

In most cases, therefore, the machine can be disconnected from the compressed air supply when it is not operating. For this purpose, a solenoid valve is installed in the compressed air supply line upstream of the machine. The valve opens as soon as the machine starts operating, and closes when the machine is turned off. In case of doubt, ask your machine supplier whether the machine can be disconnected outside operating times. You can find more information in the Guideline on optimising compressed air from SwissEnergy.

A solenoid valve automatically disconnects a machine from the compressed air network.

Switching sub-systems or the entire compressed air system on and off manually

Individual sub-systems or the entire compressed air system can also be switched off and back on manually.

But be careful to avoid errors when switching on and off manually, because if the ball valve is wrenched open when switching on instead of being opened slowly, the system can be damaged. Filters can be torn, and water or oil can penetrate the pipe network and cause serious damage to the machines.

Experience also shows that people repeatedly forget to switch off manually. The compressed air system continues to operate even though no compressed air consumers are active.

You can find instructions on switching on and off manually in the Guideline on optimising compressed air from SwissEnergy.

Additional information

- Short film: Energy efficiency in companies: switch off the compressed air

- Guideline on optimising compressed air, information for staff responsible for compressed air
- 4-step check to optimise a compressed air system, work instrument for staff responsible for compressed air
- Guidance on compressed air, boosting efficiency in compressed air systems

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Images: Rolf Gloor/zweiweg

09/2022

Let your servers chill out – and save money!

Many companies use their servers with the basic setting as delivered. With targeted use of energy-saving features, you can considerably reduce the electricity consumption of your servers.

Action

Activate the energy-saving features or the energy management tool on your server – and save as much as 40% of the energy consumed.

Requirement

You operate an in-house server room (a small data centre) or your own servers in your company.

What to do

- Check whether your servers have energy-saving features or an energy management tool. If this is not the case, ask your supplier to install an application of this type.

How to start:

- Log on to the server as an administrator.
- In the backup programme, clarify the times when your backups are active.

How to activate the main energy-saving features on the server:

- Define the power schedule
- Select the ventilation mode
- Define the hard disk rest (sleep) mode
- Activate “Wake-on-LAN”
- Switch off unused services

See overleaf for details.

Costs – outlay

- If energy-saving features or an energy management tool are installed, your “only” outlay is your own labour, of about 1 to 2 hours.
- If you have to retrofit the energy-saving feature, ask your supplier for information about the labour charges and any licence costs that may be incurred.

Please note

- When making adjustments to the server system settings, it is worth calling in an IT specialist in case of doubt – because secure, reliable and trouble-free operation of the IT infrastructure is essential for all companies, and the costs of IT outages can mount up very quickly.

Additional explanations

Activate the power schedule

Small servers that are not active at night can be shut down using the power schedule. To do this, you should ideally arrange the backup times so they are usually completed about 1 hour before work begins (reserve). With a power schedule, you can then automatically shut down and restart the servers after work ends, until the backup begins.

Example:	End of working day	6:00 pm
	Switch server off	8:00 pm
	Switch server on	04:15 am
	Start backup –	04:45 am
	Backup duration (e.g. 45 minutes)	
	End of backup	05:30 am
	Reserve (1 hour)	06:30 am
	Start work	06:30 am

Set ventilation mode

For the ventilation mode, select the operating mode where the fan (ventilation unit) speed adapts to the actual requirements of the server according to its system temperature.

Hard disk rest mode

Ensure that rest (sleep) mode for the hard disks is already activated after a short time (e.g. 30 minutes).

Switch off unused services

Active services that are not used by the server or any applications consume energy unnecessarily. Check the services in your system settings. Uninstall or disable the services you do not use. In case of doubt, if you are not sure whether a particular service is required by applications, you are best to allow it to run.

Wake-on-LAN

Shut the server down manually or with the help of a scheduler. With Wake-on-LAN (WOL), you can "wake it up" from any workstation so that it starts up automatically. To do this, you must enable Wake-on-LAN in the system settings and define a schedule.

Additional information

- Less electricity and more efficiency in server rooms and data centres: Information platform for server rooms and data centres, SwissEnergy
- Promoting efficient data centres: the PUEDA+ funding programme
- Site analysis for your company: The energy check for server rooms and data centres
- Efficient data centres: list of actions

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Images: 123rf.com

09/2022

More is less: don’t cool your servers below 27 °C

Modern servers still operate reliably with a supply air temperature of 27 °C. Cooling the air down to a lower temperature with the mechanical cooling system requires unnecessary energy and increases the operating costs.

Action

Allow temperatures of up to 27 °C in the server room to cut your cooling costs by as much as 60%.

Requirement

You operate an in-house server room (a small data centre) or your own servers in your company.

What to do

- Measure the temperature in the intake airflow, in the uppermost position of the server installation. The temperature at the top of the rack is usually somewhat higher.

A: For air-cooled server rooms with their own split air conditioning unit:

- Set the split air conditioning unit so it only starts cooling the air in the intake flow at 27 °C.

B: For air-cooled server rooms that are cooled via the central cooling system:

- Set the room cooling so the air in the intake flow only starts cooling at 27 °C.

C: For water-cooled server rooms that have their own cooling system (air-water):

- Set the water circuit temperature so that cooling of the air upstream of the servers only starts at 27 °C.

Costs – outlay

- A simple factory-certified thermometer with an accuracy of ±0.1% costs between CHF 100 and CHF 150.

Please note

- The ambient temperature in the room can be up to 30 °C or more if a separation between the cold air going to the server and warm air coming from the server is present in the room. The high room temperature has no negative impact on equipment availability. Ideally, the supply air temperature is adapted to the actual demand, and is not kept at a constant temperature level.
- Targeted dehumidification of the supply air is not usually required. Ensure that the relative air humidity in the room is between 20% and 80% (also see overleaf).

Additional explanations

Increasing the temperature

According to ASHRAE[1] 2012, the industry standard, and the IT equipment manufacturers, it is possible to increase the supply air temperature upstream of the IT equipment to as much as 27 °C without problems. In this case, adhere to the requirements specified by the hardware suppliers (servers, hard disks, switches, etc.).

Pay attention to air humidity

ASHRAE also recommends a higher tolerance for humidification of the supply air in order to keep energy expenditure low. The relative humidity must not be less than 20% (static discharges) so the equipment is not damaged. However, humidification to more than 30% relative humidity is just as unnecessary as dehumidification to below 70% relative humidity. In overall terms, the accepted bandwidth for air humidity in the server room is broad (e.g. 20% – 80% relative humidity) before there is a need to condition the air.

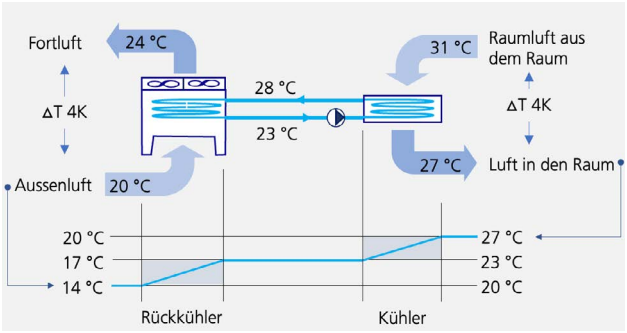
Avoid solar radiation into the server room

Protect the server room against direct solar radiation. This is because the sun introduces additional heat into the room, which then has to be removed again by the cooling system. If external windows cannot be avoided in server rooms, they therefore require good shading (blinds).

Use free cooling when outdoor temperatures are low

Server rooms need to be cooled throughout the year. This makes them particularly suitable for “free cooling”. Please note: valuable heat is removed with free cooling. If you can use this heat in the building (for heating in the transitional period), utilisation of heat makes more sense than free cooling. But if you are not able to use the heat, the server room can be cooled with free cooling.

- With air-cooled systems, you can use the cold outside air (up to 27 °C) directly as supply air.
- With water-cooled systems, the cooling water (and therefore – indirectly – the server room) is cooled by the outside air, without a mechanical cooler. This indirect free cooling operates with two heat exchangers, each of which requires a temperature difference of 3 to 4 K in order to operate cost-effectively. This means that outdoor temperatures of less than 20 °C are necessary for indirect free cooling (see image).



Additional information

- Less electricity and more efficiency in server rooms and data centres: Information platform for server rooms and data centres, SwissEnergy
- Promoting efficient data centres: the PUEDA+ funding programme
- Site analysis for your company: The energy check for server rooms and data centres
- Efficient data centres: list of actions

[1] The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) publishes standards and guidelines for air conditioning technology, including ASHRAE TC 9.9 – Data Center Power Equipment Thermal Guidelines and Best Practises – regarded in the industry as the standard reference for air conditioning in data centres.

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Images: 123rf.com and zweiweg

09/2022

Using your server capacities virtually will save money and energy

Virtualisation allows you to optimise the capacity utilisation of your servers as well as memory and network resources. This way, you minimise the number of physical servers and the amount of storage capacity required. And you also reduce the energy demand for your server infrastructure by 40% to 60%.

Action

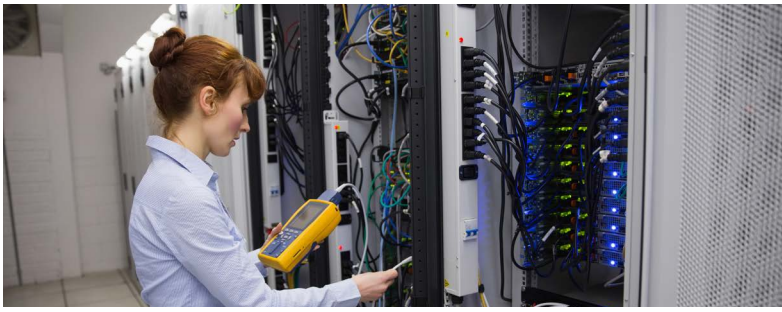
When you next expand your server infrastructure, take advantage of the opportunities offered by virtualising your server architecture. That will save up to 60% of your energy consumption.

Requirement

You operate an in-house server room (a small data centre) or several of your own servers in your company.

What to do

- Analyse the utilisation of your servers' capacity for two to three months.
- Consolidate the data so you can define the effective storage requirement for all your servers and applications.
- Assess which server applications with their own hardware (mail, ERP and web servers, etc.) you can consolidate on one physical server.
- In connection with the virtualisation, also consider (partial) cloud outsourcing for the server infrastructure.
- Avoid storing old, unnecessary or duplicate data ("data garbage").
- Design the concept for your new virtual server, storage and network infrastructure. To do this, evaluate the necessary software and (if required) the hardware components that are missing.
- Implement the virtualisation concept.



Costs – effort

- If you don't have an IT expert with experience of virtualisation projects in your company, it is worthwhile to develop and implement the virtualisation concept in collaboration with an external IT partner.
- The actual investment costs for hardware are often low. But you may also need to consider the effort expended by your IT staff for planning and implementing the virtualisation solution.

Please note!

- Secure, reliable and trouble-free operation of the IT infrastructure is essential for all companies. Always call in experts if you don't have sufficient IT experience.
- The minimum time required for a virtualisation project is between three and six months.
- The potential for savings is very promising: power consumption by the storage systems (for example), which easily accounts for one quarter of the power required by the server infrastructure, can be reduced by up to 80%.

Additional explanations

Server capacity utilisation

A virtual server forms what are known as storage pools – for example, from the storage capacities of the individual physical servers. This enables the storage space to be used dynamically. Storage capacity can be used more efficiently, and it becomes possible to work with less physical storage space. This cuts costs (hardware) and saves energy (less connected power). Moreover, server capacity utilisation is improved – which, in turn, saves energy.

A server in idle mode (i. e. when no work is being done) still consumes 50% to 75% of the electric power it would require if its full capacity were utilised. The following example shows three servers with electrical power of 400 watts each (total: 1200 watts) and their capacity utilisation. With unchanged capacity utilisation, the data can be processed on a virtualised server with only 600 watts of connected power.

Capacity utilisation control

The server infrastructure is often over-dimensioned, even if it is already virtualised. This means that most servers operate at less than half their potential capacity, and the full potential of virtualisation is not exploited. So: clarify your actual requirements for physical servers, and implement targeted reductions of overcapacity. Remember that server capacity utilisation of 80% to 90% presents no problems for the hardware, given proper operation and correct cooling.

Additional information

- Less electricity and more efficiency in server rooms and data centres: Information platform for server rooms and data centres, SwissEnergy
- Promoting efficient data centres: the PUEDA+ subsidy programme
- Situation assessment for your company: The energy check for server rooms and data centres
- Efficient data centres: list of actions

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Visuals: 123rf.com (title image), two-way

02/2023

Targeted promotion of cycling strengthens the health of employees in your company

Physical activity stimulates blood circulation – so it also leads to improved productivity. Employees who cycle to work are doing something good for their health – and they are reducing the energy consumption triggered by the company.

Action

Targeted promotion of cycling boosts performance and promotes employees' health.

What to do

- For example: on your intranet, assemble all the bike promotion information, offers and activities available from your company or in your immediate vicinity (e. g. bike-sharing services).
- Establish your employees' requirements for bike infrastructure. Conduct a short survey for this purpose (see overleaf).
- When you evaluate the survey, focus on the concerns of employees who are positively disposed to cycling.
- Analyse why cycles are not used to travel to and from work, and what is needed for this to change.
- On this basis, develop measures that will deliver the greatest benefits for your company and your employees. These could include
  - covered bike parking places
  - charging facilities for e-bikes
  - changing areas
  - cloakroom/changing room lockers
  - shower facilities
  - joint after-work repair course
  - participation in the "bike to work" campaign
- Involve your employees in evaluating the measures, and implement them in your company.

Costs – effort

- Depending on the size of your company, the survey and evaluation will result in one to two days' work.
- There are also the costs of
  - implementing infrastructure measures (such as purchasing and installing bike stands)
  - promotional and team-building activities (such as a flat-rate bike contribution, or a contribution to a bike-sharing subscription)
- You may possibly need fewer staff parking spaces in the medium term, which can result in cost savings.

Please note!

- It is often not possible or sensible to implement all the actions at the same time. In this case, start out with a project that you expect to meet with high acceptance. Collect initial experiences, and then put the next steps into practice gradually. The goal is also for you to create an enthusiastic biking community among your employees by making your contribution to sustainability.

Additional explanations

Employee survey

A short employee survey is an important basis for a bike promotion project that is precisely tailored to the needs of the employees in your company. If you know the actual requirements and the potential, you will save costs and time when you implement measures to promote cycling. For example, this will prevent you providing showers that are then never used.

In companies with up to 20 employees, a printed questionnaire that you evaluate manually is suitable for the survey. In larger companies, it is worth using an online tool to conduct the survey. You can find various solutions for this on the internet – some are free whereas others require payment, but these usually offer more possibilities for evaluating the data.

SwissEnergy offers you a model questionnaire for your employee survey; it takes little effort to adapt it to your requirements.

Model questionnaire
Promoting cycling for employees

Cycling promotes health

There are many ways of reducing stress. Endurance sports – and cycling in particular – have proven to be particularly effective for this purpose. Uniform cyclical movements have a calming and relaxing effect on people. Cycling also strengthens the muscles in the legs, back and neck, so it can prevent painful tension caused by long periods spent sitting behind an office desk. Healthy employees will thank you by reducing their absences.

Motivation and communication

There are many good options for you to promote cycling in your company. Here are two examples as suggestions:

- **bike to work:** “bike to work”, a nationwide campaign run by Pro Velo Switzerland, promotes your employees’ team spirit and fitness as well as helping to encourage sustainable mobility behaviour. “bike to work” takes place in May and June each year. Around 80’000 cyclists from 2800 companies and organisations pedal to work every day. They record how many kilometres they cover in a “Challenge Calendar” which they use to enter a grand prize draw. The company pays the moderate participation fee for the project, which is based on the number of employees.
- **Company outing by bike:** it doesn’t always have to be a cruise on Lake Lucerne! E-bikes open up options for new types of team-building that motivate the whole workforce to get involved in sport. For example: an excursion along a pretty lake or river that could be combined with cultural and culinary experiences. And who knows? Maybe one or more of your employees will get a taste for cycling and use their bike for the journey to and from work in future.

Additional information

- Mobility management in companies, SwissEnergy
- Bike to work, Study by the University of Lausanne
- Funding contributions for mobility projects in companies

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Illustration: Shutterstock

01/2023

A good environment for mobility boosts employee satisfaction

With a mobility concept, you lay the foundation for the increased use of public and non-motorised transport by commuters. This reduces both your mobility costs and your company's environmental footprint.

Action

An analysis of commuter behaviour and your company's mobility environment serves as the basis for making decisions regarding employee-friendly mobility that saves resources.

Benefits

Employees who travel to work using public transport, on their bikes or by foot reduce the number of parking spaces your company needs. Commuting by train also results in much greater productivity than driving a car.

What to do

Step 1: Preparation

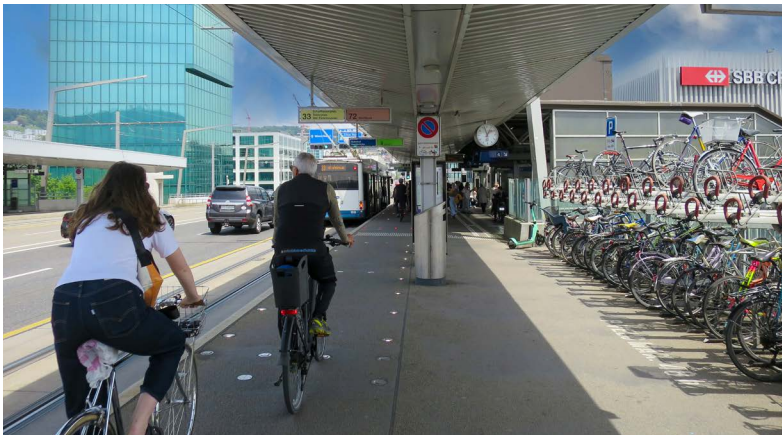
- What aspects of the analysis are you able and willing to take care of yourself, and what do you need support with?
- If necessary, you can engage a mobility consultant to help with step 2 and/or the implementation.

Step 2: Analyses

- Analyse your company's mobility environment.
- Carry out a commuter route analysis by surveying your employees (see page 2).
- Have the consultant draw up a mobility concept that includes a list of measures, or come up with suitable measures yourself.

Step 3: Implementation

- Implement the mobility measures that are suited to your company.



Costs and workload

- You will need two to four person days of internal capacity for the analyses.
- You may also need to pay for external mobility consultancy services, which can cost anything from CHF 2000 to CHF 10'000 depending on the size of your company and the services you need.

Please note

While a mobility concept is an important thing to have, it doesn't do much by itself. It's only when the measures recommended as part of the mobility concept to improve the use of public and non-motorised transport are implemented that the proportion of motorised personal transport, and the company's environmental footprint (CO_2 emissions) and mobility costs, will fall.

Additional explanations

Where can I find a consultant?
The website of Mobility Management Suisse (MMS) provides a list of specialist consultants.

Analysis of the mobility environment
Evaluate the quality of the public transport, vehicle sharing and non-motorised transport facilities in the area where your company is based. Important factors include
- The nearest public transport stops
- The number and frequency of public transport lines
- Hours of operation
- Non-motorised transport facilities (PubliBike, electric scooter sharing, etc.).

Employee survey
Conducting a survey of your employees is essential in order to ensure that any mobility measures are suited to your company. You find out how your employees commute and for how long, what means of transport they use, what requirements they have, and what action is urgently required.

In companies with up to 20 employees, this can be done using a printed questionnaire that you evaluate manually. Bigger companies are better off using an online tool for the survey. You can find various solutions for this on the internet. Some are free, and while others require payment, these usually offer more possibilities for evaluating the data.

SwissEnergy offers a model questionnaire that can easily be tailored to your requirements.

Model questionnaire
Employee mobility behaviour

Mobility concept with list of measures
The employee survey serves as the basis for analysing commuter journeys, which gives you an exact overview of travel times and emissions. Together with the evaluation of the mobility environment, this can be used to develop concrete measures aimed at improving your employees' commutes that are tailored to your company. These could include
- Promoting carpooling
- Bike sharing facilities between the station and the place of work
- Shuttle buses during peak times for locations with poor public transport connections
- A dedicated night taxi service for shift workers and employees working late
- Flexible working arrangements to allow employees to avoid peak times
- Incentives for employees to use public transport (taster passes, discounted passes, etc.)
- Working with the transport network to offer additional discounts (e.g. Jobtickets)

The mobility concept should describe every measure in detail, including
- A definition of the goals (concrete, measurable)
- The implementation and incorporation into the mobility environment
- The potential available (benefit to employees, reduction of mobility costs and emissions, etc.)
- The initial expense and recurring costs
- The time required for implementation

Waste no time getting started with the first measures in order to signal your commitment to environmentally conscious mobility.

Additional information
- Mobility management in companies, SwissEnergy
- Mobility Management Suisse (MMS)

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Illustration: zweiweg

01/2023

Reduce energy consumption in unused buildings and rooms

Well-planned implementation of home office working for your employees will cut energy consumption if you reduce the operating levels of your heating, ventilation, lighting and IT equipment at the same time.

Action

Reduce the room temperature and switch off all unnecessary equipment that consumes electricity when the building or parts of it are not in use.

Requirement

Your employees work from home offices, and the building (or individual areas and storeys) are standing empty.

What to do

- Plan your home office operation, and define which parts of the building do not need to be used. Your company's technical department will assist you with this.
- Combine vacant areas (see overleaf) and check whether the heat and air distribution can be controlled individually.
- Turn the heating and ventilation down:
  - Reduce the room temperature (12 to 18 °C).
  - Reduce airflows.
- Switch off equipment that consumes electricity and optimise the intake of natural air:
  - Switch the lighting off completely.
  - Disconnect electrical, electronic and IT devices (printers, WLAN routers, WLAN repeaters, vending machines, water dispensers, etc.) from the power supply (no standby mode).
  - Close doors, gates and internal windows in the building.
  - When the sun is shining in directly during daytime in winter, roller shutters and louvres/ blinds should be opened. They should close tightly when the sun is not shining.

Costs – effort

- A specialist can implement a reduction programme for heating and ventilation in half a day. For small buildings (if you have a little technical skill), you can implement this setting yourself.
- Lowering the room temperature by one degree Celsius will reduce the energy consumed for heating by 6% to 10%.

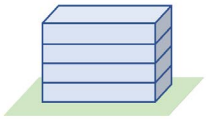
Please note!

- Home office working will cut your costs and save energy. However: you are passing part of your energy consumption on to your employees. It is best to deal with this issue in the expenses regulations. For example, you can compensate "passed-on operating costs" with a monthly flat-rate payment (see the additional information, link: "Home office and expenses in Switzerland").
- In the fact sheet "Working in your home office", your employees will find suggestions on how to keep their energy costs down when working from home.

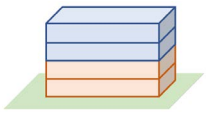
Additional explanations

Variants for reduced operation

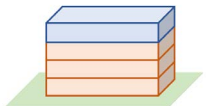
To achieve lower room temperatures in individual parts of a building, you must combine these rooms to create a “cool unit”. Also, the heating system must support individual controls of this sort in the building. This is not always the case, especially in older buildings.



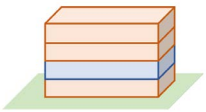
Ideally, you should set the entire building to “economy mode”. This is technically the simplest solution, and it produces the best effect.



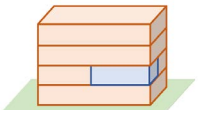
If you continue to use parts of the building, combine the unused areas into one unit.



If only one storey is to be “cold”, the top floor is the best choice in terms of saving energy.



If the top floor has to remain in operation and an intermediate floor is standing empty, the temperature here should only be reduced slightly (to about 18 °C). Reduce the airflows, and consistently switch off the lighting and electrical equipment.



It is technically difficult, if not impossible, to reduce the temperature in one single area of an intermediate floor – and the savings from this are very low. But even in this case, switching off all power consumers is effective.

Define the right room temperature

Temperature reduction is influenced by factors such as building design, the heating system, and the usage and position of the rooms. In office buildings that are not used for lengthy periods, you can reduce the room temperature to between 12 and 14 °C. If you alternate usage of the building – heated from Monday to Thursday but at reduced temperature from Friday to Sunday – a reduction to between 16 and 18 °C should be a practicable solution. In both cases, observe how the building behaves (humidity, condensation) and how long it takes for the rooms to become “warm” again after a reduction.

Ventilation

Ventilation is often forgotten when considering how to reduce energy consumption. But reducing the airflows to meet effective demand actually opens up important potential for savings.

Organisational aspects and communication

Astute organisation of home office operating mode is just as important as the technical measures. Control workplace occupancy so that all the employees on one floor are working from their home offices – or on another level of the building. That allows you to shut the whole floor down completely. Or: launch a regular home office day for the entire workforce on Fridays – so you can already put the whole building into “economy mode” on Thursday evening.

Additional information

- Information sheets on operational optimisation for practical use
  - Heating 02: Reduce the temperature at night
  - Ventilation 01: Adapt operating times
  - Miscellaneous 02: Working in your home office
- Energy manual for caretakers, SwissEnergy, 2022
- Home office and expenses in Switzerland – an overview, Handelskammerjournal (Journal of the Chambers of Commerce) 2021

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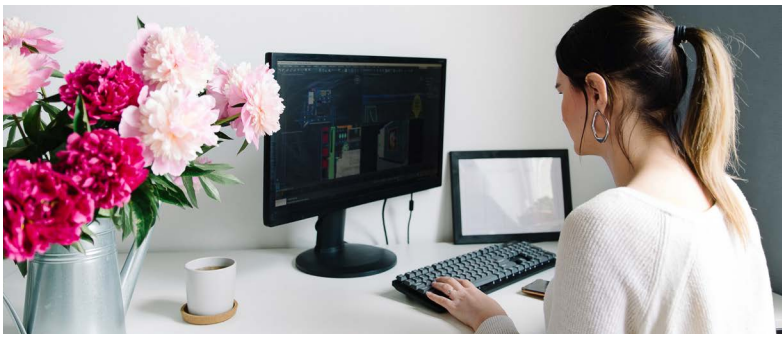
Working in your home office can be pleasant without wasting energy

There are plenty of steps you can take in your home office to save energy and cut costs. They all add up to a valuable contribution to the fight against energy wastage.

Action
Be aware of how you use energy, and switch off all unnecessary equipment that consumes power.

Requirement
You work from your home office and you want to save energy and cut costs.

What to do
- Close the room door so as to retain the heat in the room where you work.
- Ventilate regularly. Open the windows fully – but only for short periods (see page 2).
- A small workstation lamp provides optimal lighting for your home office space.
- Switch the lighting off as soon as sufficient daylight is available.
- Switch computers, screens and printers off completely during your lunch break and in the evening.
- Always charge mobile devices with the cable, not with the wireless charging pad.
- If possible, use the internet with a cable connection (Ethernet etc.), not with a wireless system (WLAN, G4 or G5 mobile network). Cable solutions are also faster and more secure.
- Only switch the printer on when you need it. Laser printers in particular cause high standby losses.
- Check whether you can switch your router off completely at night – between 11:00 pm and 5:30 am, for example (see page 2).
- Activate the energy-saving function on your office equipment (see page 2).



Costs – effort
- An average household has standby consumption of 25 to 35 watts, causing superfluous electricity costs of around CHF 40 per year. Typical standby consumers in an office are notebooks (1 to 3 W), screens (1 to 2 W), modems (7 W) and chargers or power units (0.1 to 3 W, depending on their age).

Please note!
- In home offices, the breaks are often the times when most energy is wasted. Only heat up the amount of water you actually need for your tea or instant coffee (one cup or, better, one whole Thermos flask). Always use the electric kettle to do this – never a pan. Switch your espresso machine off completely after using it. Do not wash up manually; always use a fully loaded dishwasher. Incidentally: when you wash your hands, cold water is perfectly adequate for a clean and hygienic result.

Additional explanations

The right room temperature

For home office working – i. e. office work – the Swiss Society of Engineers and Architects (SIA) recommends an indoor temperature of 21 °C and relative humidity of 30% to 60%. If your home is heated to between 19 and 20 °C in winter (or if you actively reduce the temperature), note the following points:

- Put on a warm pullover and move about or exercise regularly during breaks from work.
- Close the door to your home office so as to save the valuable "waste heat" given off by your body, the lighting and all the office equipment that uses electricity.
- When the sun is shining, open the window shutters and roller shutters to let the natural heat come into the room.

Ventilate regularly

You must ventilate your workspace regularly, even though this requires energy. This is because "used" air with a CO_2 concentration of more than 1000 ppm has a significantly negative effect on performance. Ventilate five times a day: before you start work, during your morning and afternoon breaks, after lunch, and after you finish work. At these times, open the window fully for two to three minutes. In apartments or homes with a ventilation system (comfort ventilation), additional ventilation through the windows is not necessary. Half-open or tilted (bottom-hung) windows increase energy consumption without noticeably improving the air quality.

Lighting

During winter, artificial light is often needed in the mornings until there is sufficient daylight to work. Modern lighting systems in offices will then switch the lights off automatically. At home, you have to switch the lights off yourself – something that's easily forgotten. One LED desk light is often sufficient for working at home. It requires only 3 watts – about five times less electricity than an LED ceiling light.

Switch IT equipment off completely

Computers, screens and printers are running round the clock in many home offices. That means they consume precious energy in standby mode. Although this only costs an individual person a few francs a year, the IT devices in Switzerland's 3,9 million households cause standby losses totalling 180 GWh – equivalent to about 6% of the power generated each year by the Beznau 1 nuclear power plant. You can very easily prevent some of this pointless energy wastage: switch all your devices off during lunchtime, in the evenings and at weekends, and disconnect them from the mains with the help of a power strip (switchable power bar).

Switch routers off at night

Before you switch routers off at night, check whether your internet provider performs security updates during this period. Also, note that many household devices (telephones, surveillance cameras, smart lighting and heating systems, smart home devices, etc.) do not function without a router, or their function is restricted.

Activate energy-saving functions

You can go to the system settings to activate the energy-saving function for your computer, monitors (screens) and printers. The software menus for this purpose are often self-explanatory; the operating system and the individual hardware determine what is possible. Please note:

- The screensaver is a relic from the past. It is technically superfluous, and it increases power consumption by up to 50%.
- Reduce the screen brightness on your monitor or notebook to 70%. This will generally be sufficient.
- Activate standby mode on all devices after 5 minutes without activity.

Additional information

- Efficient office equipment
- Standby mode
- Everyday ways to save energy, SwissEnergy, 2022
- Energy efficiency in the household, SwissEnergy, 2021

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