GOOD PRACTICES IN SME

Energy efficient cooling installations

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What does modernizing the cooling production installation consist of?

When considering the installation of air condition equipment, it is important to consider its cost- effectiveness based on the potential benefits and losses. Particular attention should be given to the buildings age, its technical condition, window airtightness, the average humidity, or its geographic location.

The first step is choosing cooling equipment with a power rating appropriate to the demand. It is assumed that cooling demand is equivalent to 80-150 W/m^2. This means that for a room with an area of 60-70 m^2 we need an air conditioning unit rated for 7 kW.

The next step is choosing the type of the cooling equipment: compressor, absorption, or adsorption. Compressor appliances are characterised by much higher efficiency factors, while their investment cost is also relatively low. Due to this they are the dominating technology on the market. Absorption cooling equipment allows the utilization of high-temperature heat sources (e.g. waste heat or hot water from a heating plant) for refrigeration and air conditioning purposes. However, their high cost makes investments rarely cost-effective. Considering the constantly rising demand for air conditioning (and therefor for electrical energy at the same time), the limited capabilities of the electricity systems, and low demand for heating in the summer, absorption technologies have a significant potential for development. Their competitiveness will only increase with rising electricity prices.

In the case of larger rooms (e.g. open space) it is better to install multiple air conditioning units with a lower power rating rather than a single, more powerful unit. This allows for the creation of climate control zones, in which only the zones currently demanding it will be cooled, ensuring even cooling and limiting energy consumption by the air conditioning system.

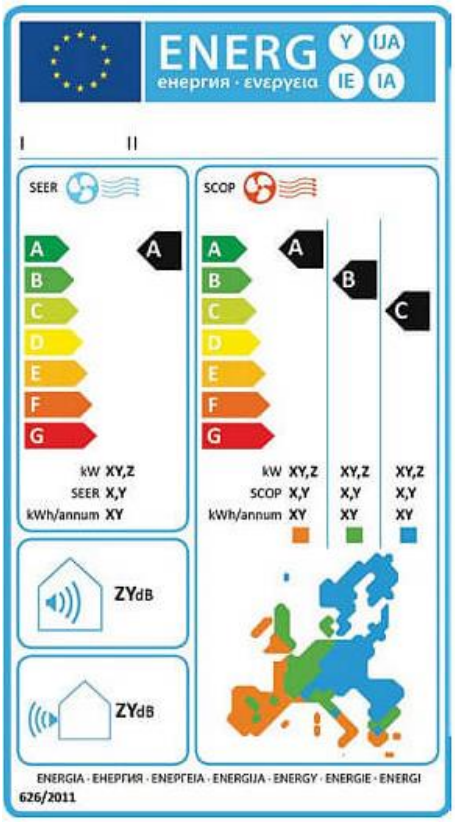
Pic. 1 x-klima: Split-type wall mounted air conditioning unit

Pic. 2 rencraft: Absorption refrigerator

How to decide which cooling appliance is more energy efficient?

We use the following indicators to describe the efficiency of heating and cooling equipment:

•COP (Coefficient of Performance) – heating efficiency factor,
•SCOP (Seasonal Coefficient of Performance) – seasonal heating efficiency factor,
•EER (Energy Efficiency Ratio) – cooling efficiency factor,
•SEER (Seasonal Energy Efficiency Ratio) – seasonal cooling efficiency factor.



Pic. 3 performance label of an air conditioning unit providing heating and cooling

The COP and EER factors are defined for laboratory conditions, meaning that it is more prudent to use SCOP and SEER, as they are defined through the annual energy consumption under real life conditions. The higher the value of the coefficient, the higher the energy efficiency of the appliance.

When purchasing cooling equipment consider the EER and the SEER. If purchasing air conditioning units for both heating and cooling it is necessary to take all four factors into account.

It should be remembered that to a large extent heating and cooling energy efficiency coefficients depend on the temperature, meaning that energy consumption of the cooling equipment can be higher than that indicated by the cooling efficiency factor. Moreover, the lower the temperature set in each room, the less efficient the operation of the air conditioning unit. For this reason, if it is possible, one should check the EER and SEER for the temperature at which the appliance will usually operate.

The temperature of the heat source is also an especially important factor for adsorption and absorption equipment. The higher the temperature of the heat source, the higher the EER of the appliance. Adsorption equipment require a heating source with a temperature above 60°C, while in the case of absorption equipment, a heat source with a temperature above 85° is required. This means adsorption equipment can use network heating, however for certain use-case scenarios absorption equipment can have better cooling efficiency coefficients.

The evaluation of an appliance's energy efficiency is made easier by energy performance labels which contain information on the EER i SEER factors, as well as the appliance's performance class. Energy performance classes allows for the comparison of the equipment's energy efficiency: e.g. the efficiency of AC units in class B is about 10% lower than that of class A units with the same power rating, A++ is about 10% more efficient than class A, and class A+++ is about 20% more efficient than class A++

When choosing an air conditioning unit, it is also key to take note of its regulation. Inverter regulation (smooth regulation of cooling power) allows for better energy efficiency coefficients (up to 30%), by avoiding losses caused by transition states when the temperature in the room changes (for example when the AC unit is turned on). A classical air conditioning unit usually works under higher load in transition states to achieve the desired temperature.

How to ensure optimal air conditioning operation?

1. Eliminate concurrent heating and cooling of rooms. When in operation all windows should be closed. Moreover, close doors between air-conditioned and non-air-conditioned rooms.

2. The temperature difference between air-conditioned rooms and outside should not exceed 8 °C. This also prevents thermal shock after leaving the building and will not cause an excess load to the cooling system.

3. When possible cover the windows, as to limit the room heating up due to solar radiation.

4. Conduct regular air conditioning maintenance. The air conditioning unit will be cleaned (a dirty filter lowers energy efficiency), and it will be checked for proper functioning (there is a risk of coolant leaks, which not only lowers efficiency but can also be harmful to the environment).

Source: KAPE