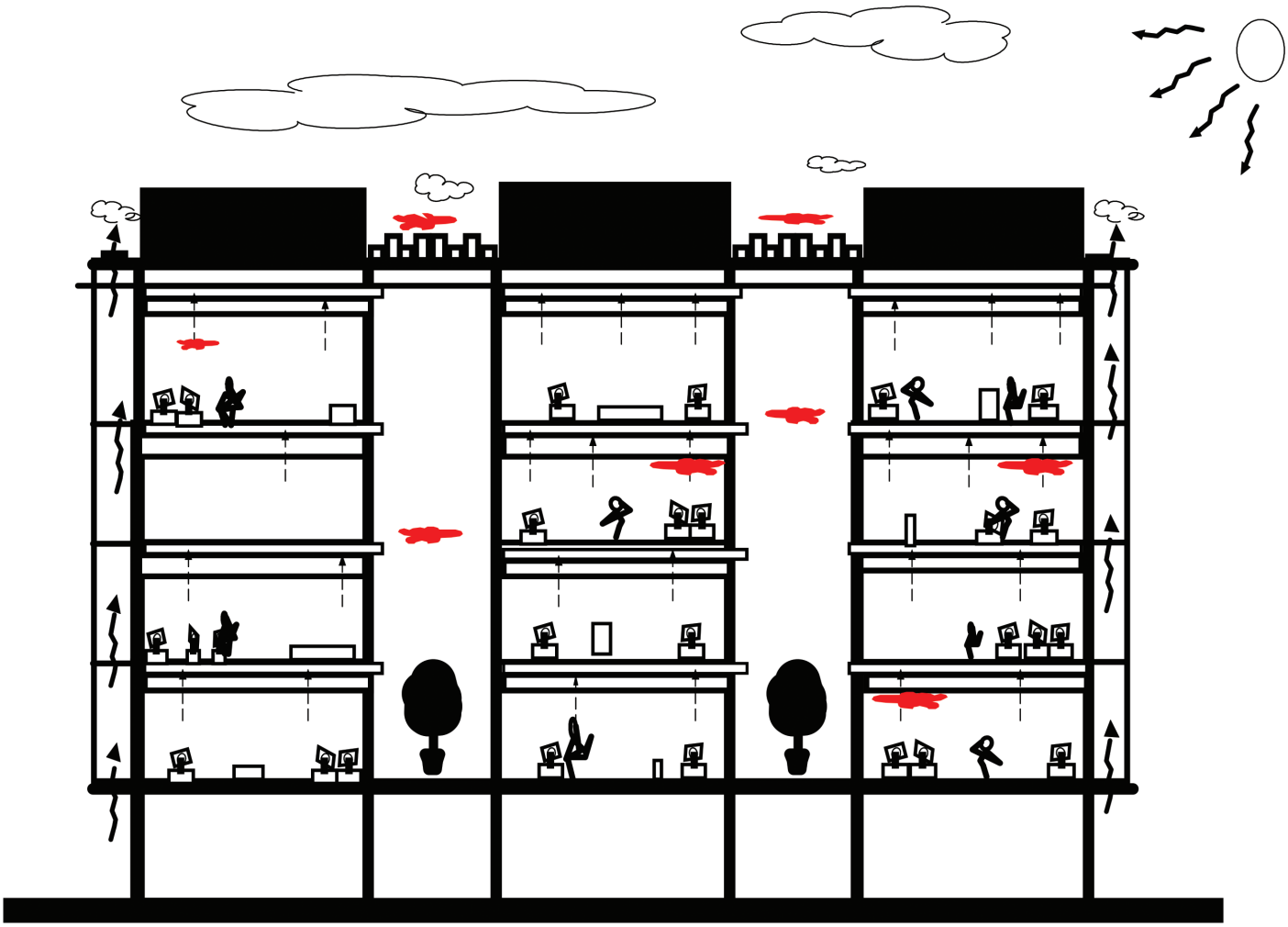

Save energy with thermo-energy: a building that acts like huge thermos

A great advantage of a well insulated building is the minimal loss of heat. This reduces the cost of heating during winter, but it can get very hot inside during summer. A lot of energy is expended to cool down the building to a comfortable temperature. But there is another, better, solution. Instead of cooling the building by blowing out excess heat, this can also be achieved by storing heat inside the building. This excess heat can be stored in places where it does not cause inconvenience. By storing instead of expelling the heat, a lot of energy is saved.

Everybody knows about the thermos: a flask to keep hot or cold liquids at their desired temperature for hours, without the need for a power source. A thermos flask is made up of two layers with a thin layer of air separating the two. The thin layer of air acts as an insulator, keeping any liquids inside from cooling down or heating up. The scientific term for this is conservation of energy.

From a certain perspective buildings are comparable to thermos flasks. The insulation in the outer wall of the building keeps the interior from being affected by outside temperatures. This works perfect during winter, but during summer these buildings get really hot inside. The heating from people, machines and sunlight shining through windows are harder to ventilate from a well insulated building. These high temperatures are not very comfortable, especially when at work. The usual solution for this problem is to expel the excess heat with a cooling system.

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Free Energy

Extracting heat from a building can be very wasteful, because heat is essentially energy that enters the building for free during summertime. If heat would be stored inside the building without causing any inconvenience, it could be used at a later moment. For example late at night, or to warm up the building for the next morning.

Taking advantage from free energy is comparable with a cyclist riding down a hill. On top of the hill he has a lot of free energy. If he lowers himself to reduce drag and doesn't brake he maximizes his use of free energy and there is no need to pedal.

Cool in the right place

The trick is to expel the least amount of heat as possible, and holding this heat as long as necessary inside the building. That is done by storing it in a place where the heat cannot cause any discomfort like in cellars, attics, hallways, cantinas, etc. Those are empty during working hours or are used for traffic. Another place to store a great amount of energy is in the concrete of the building itself. It wouldn't bother anybody if the concrete heats up with a few degrees.

A workplace should have a comfortable temperature. Whenever it heats up even by a small fraction the ventilation system will immediately extract the excess heat. This way the workplace will stay cool with much less or without the need for cooling. This only works with a properly calibrated ventilation system that is capable of flushing the room. With an adequate system it will only take around 10 minutes to change temperature by two degrees.

Example: INIT-building

The municipality of Amsterdam needs to reduce its energy consumption by 40% to meet environmental standards. The renovation of the INIT building is a pilot of the thermos flask concept and a project to gain the necessary knowledge. The building houses three newspapers, Trouw, De Volkskrant and Het Parool. Even though the building contains a lot of single layer glass it is very well isolated. The building can be discribed as a box in which indoor office units are built.

The INIT-building saves a lot of energy from the cooling system. The heat that enters the building through the glass is redirected by a ventilation system to the area outside the office units. This space acts like a buffer for storing excess heat, and at the same time acts as an insulator for the office units. The heat is extracted from the roof of the buffer. The temperature in the hallway, also a buffer area, will rise, but that won't pose a real problem because it is only used for traffic.

Now it takes far less energy to cool the two research office units. The cooling installation has been reduced from 1,2 megawatt to 500 kilowatt. The ventilation systems inside the office units are modified to greatly improve flow. The expected saving of energy consumption by the cooling system is 80%. Every year €40.000 is saved on the use of this cooling system.

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