ecopilot® CANADA
More comfort. Less energy.

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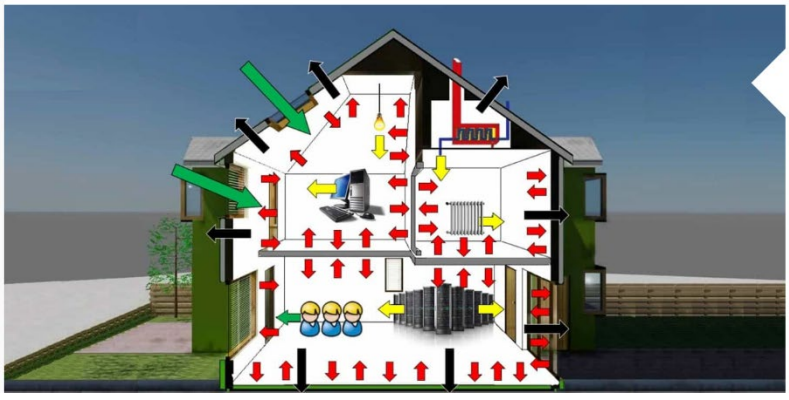
**Thermal Mass in the Built Environment**

In building design, thermal mass is a property of the mass of a building which enables it to store heat, providing "inertia" against temperature fluctuations. For example, when outside temperatures are fluctuating throughout the day, a large thermal mass within the insulated portion of a property can serve to "flatten out" the daily temperature fluctuations, since the thermal mass will absorb the thermal energy generated inside, and give thermal energy back when the surroundings are cooler.

EcoPilot was created to harness the thermal mass of your building(s) in order to keep the indoor temperature within a comfortable range while significantly reducing energy consumption.

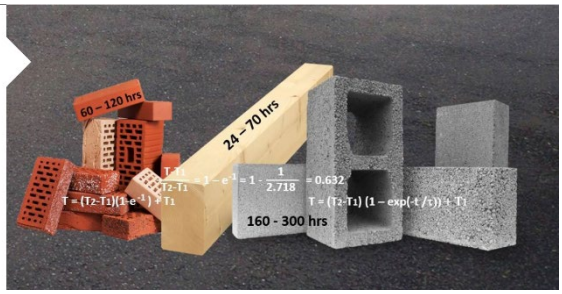
**Energy flow in a normal building**



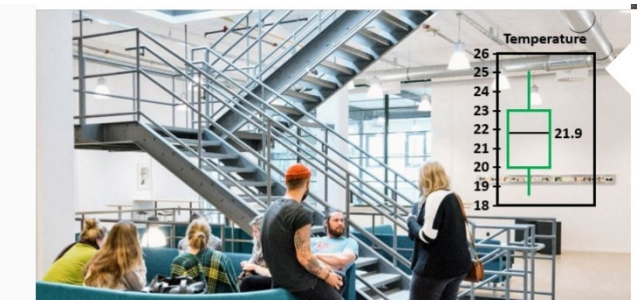
The black arrows show energy loss through the walls, roof and windows, through ventilation and by dispersal of hot water. The yellow arrows indicate purchased energy from the heating or cooling systems, from electrical equipment, lighting and hot water. The green arrows indicate free energy generated by people and weather conditions. By allowing the indoor temperature to vary within a defined temperature range, excess free and purchased energy can be stored in the building structure and furniture - the red arrows.

**Using the Time Constant of Materials**

The time constant is a mathematical definition of the time it takes for different building materials to cool or heat when there is a change in weather or outdoor temperature. The higher the time constant, the greater the materials ability to store energy. Modern buildings with low energy leakages have a greater time constant than older buildings.




**The Need to Use a Temperature Range**



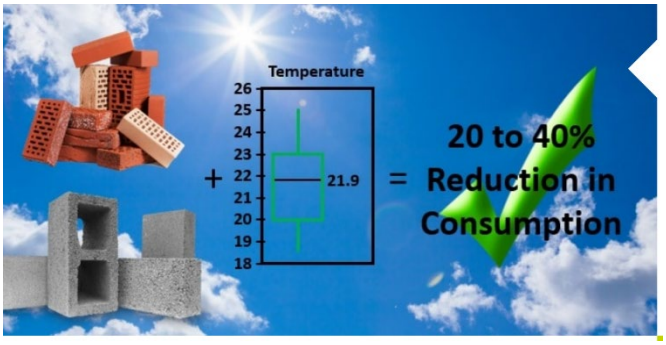

The theory states that if you allow the indoor temp to vary by 8ºC in a commercial or public building the heat saving will be 80%. In practice a span of 3-4ºC is usually more realistic (20-24ºC is common) resulting in heat savings of 20-40%. The use of a temperature range does not mean that the indoor temperature will change 3-4ºC over 24h, the average change in indoor temp over 24h is less than 1ºC, which is enough to utilise thermal storage. If no range is allowed, none of the excess free or purchased energy can be stored in the building.

**Balance Temperature**

When you work with the thermal mass of a building, the Building Management System aligns itself with the balance temperature instead of the outdoor temperature. Balance temperature is calculated using stored thermal energy, indoor & outdoor temperature, current & future weather conditions as well as other variable factors. The balance temperature allows the building to Eco-drive, since long-term energy demands are considered, ensuring your

building doesn't accelerate while braking (heat while cooling) unnecessarily, the way a traditional BMS would encourage it to do.

**Thermal Storage in Practice**




By looking at the power signature of different buildings we can find out if the energy storage technology has any potential in the built environment. The power signature is a measure of the average power usage for 24hrs compared to the average outdoor temp for the same time period.

**<u>Understanding the theory and application of thermal mass to your specific environment:</u>**

- Use the time constant to utilise the structure of buildings as an asset which can store the free energy created by users, equipment and weather.
- Implement an acceptable indoor temperature range (eg. 21-24ºC) instead of a set temperature (eg. 22ºC).
- Allow your building to utilise its variable balance point.
- EcoPilot enables you to control your building more efficiently by automatically and continuously making adjustments to the set points of a BMS 24/7. These adjustments will result in a reduction of energy consumption.

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EcoPilot Canada
528 Windmill Road
Dartmouth, NS, B3B 1B3

1-800-217-1788
info@ecopilotcanada.com