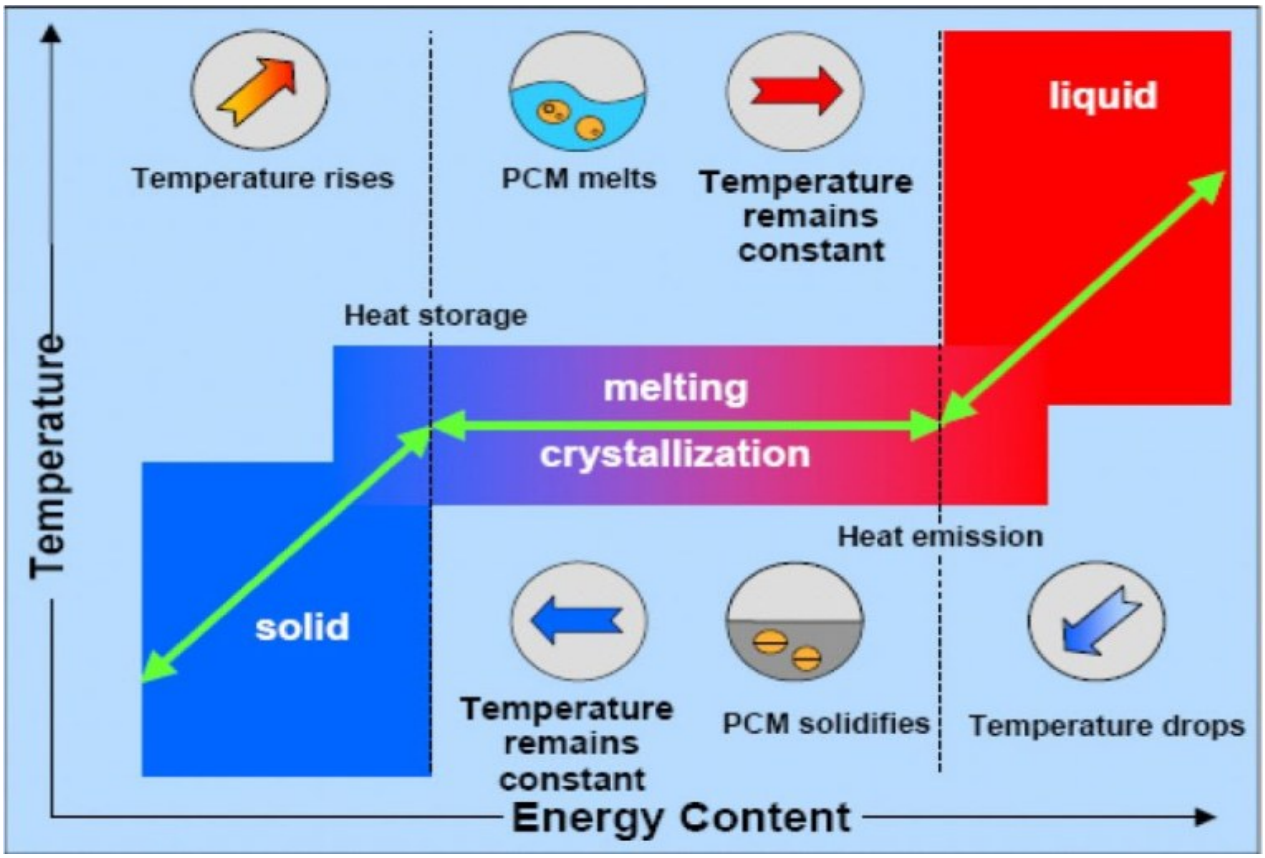
What are Phase Change Materials?



Phase Change Materials or also known as phase-transition materials and PCM-systems are used for the storage of heat and/or cold. These substances are able to absorb large amounts of energy, without changing its own temperature. Instead, the state of matter is changing during the absorbtion (melt) and/or transfer (solidify) of the PCM-material in the storage system. This phenomenon allows us to create on a simple way the storage of the surplus of energy of buildings and so stabilizing the room temperature.

In new buildings, there is no thermal mass present in the building to prevent a fast overheating. The energy consumption for cooling of buildings increases therefore enormously. PCM‘s are an energy-efficient, safe and (non-combustible) and relatively cheap solution to these problems. Basic materials are salt hydrates or watery salt solutions. Also hydraulic applications in large buffers can handle in this way very efficient with heat and cold.

Temperature differences of just a few degrees Celsius between the PCM system and the "heat source" (environment) are sufficient to absorb large amounts of energy. This over a time frame of, for example a day, store it lossless and finally according to the usage transfer it again. This process is reversible and can in this way be used for very targeted supply of heating or cooling.

A PCM of good quality is tested on enthalpy (melting heat) and cycle-stability and must endure at least between 6,000 and 10,000 (day) cycles. Assuming one such a cycle per day (melting-solidification) the energy storage system with PCM should work smoothly for more than 25-30 years.

As a part of the total system PCM‘s will save energy – for example in cooling and heating processes of climate installations. But can also safe a significant amount of space with hydraulic applications in large buffer storage systems.

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Gaia Phase Change Materials

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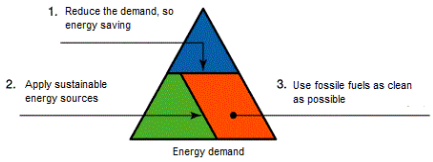
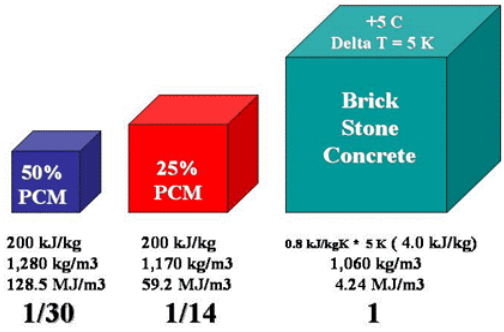
ENGINEERING & TRADE

Technical specifications:

Type	Enthalpy in kJ/kg	Specific mass in kg/L	λ in W/(m K)		Spec. heat in kJ/kg K
			solid	liquid	
PCM-30	225	1,13	2,0	0,85	3,7
PCM-20	242	1,11	2,0	0,85	3,7
PCM-16	255	1,1	2,0	0,85	3,8
PCM-10	275	1,1	2,0	0,85	3,8
PCM-5	300	1,1	2,0	0,85	4
PCM-0	330	1	2,0	0,85	4,2
PCM8	182	1,43	0,6	0,54	2,7
PCM14	193	1,48	0,6	0,54	2,7
PCM18	215	1,5	0,6	0,54	2,7
PCM20	215	1,5	0,6	0,54	2,7
PCM23	215	1,5	1,1	0,6	2,1
PCM25	200	1,5	1,1	0,6	2,1
PCM28	225	1,5	1,1	0,6	2,1
PCM36	232	1,4	0,6	0,5	2
PCM48	226	1,4	1	0,6	2,2
PCM58	235	1,4	1,9	1	2,5
PCM70	240	1,8	0,7	0,5	1,8
PCM80	260	1,86	1,2	0,5	1,1





PCM's have storage capacities at a delta T of 5K that are many times larger than the regular building materials such as brick and concrete. The image on the left indicates the storage capacity/volume if, for example, 25 or 50% of the building material is replaced by PCM's. Application of PCM's in the built environment can thus make an important contribution to the principle of the Trias Energetica. Increase the mass of the building, reduce the demand, so save energy.

Application areas include:

» Solar thermal energy (short to medium term storage of solar energy).
» Buffer storage (biomass & heat pumps for cooling and heating).
» Residential buildings (PCM-underfloor heating, HRV-units, conservatories).
» Industry (process heat, heat recovery, cold storage, peak shaving).
» Photovoltaïc systems (efficiency improvement).
» Air conditioning of office buildings, schools, nursing homes etc. (with night discharge).
» Transport (constant temperatures for flowers, fruit, vegetables, fish, meat etc.).
» Data centers (free night cooling in combination with PCM buffer storage).
» Greenhouse horticulture (temperature regulation).

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