"Increasing the thermal mass of buildings is one of the most effective solutions to achieving our global energy efficiency goals. Phase Change Materials hold the key to light-weight construction and achieving thermal mass, which greatly reduces heating and cooling requirements."

BEYOND INSULATION™

The next step in high-performance building.

BioPCM™ uses the power of phase change materials to actively absorb and release heat. These "phase changes" help maintain constant, comfortable building temperatures.

Thanks to major break throughs in design, Phase Change Energy Solutions uses sustainably grown, harvested and produced bio-based phase change materials to reduce energy consumption and CO_2 emissions. BioPCM™ shifts the warmth of the day into the night and the cool of the night into the day, all the while passively holding room temperature.

PHASECHANGE
energy solutions

bioPCmat™
beyond insulation™

A green energy solution.

BioPCM™ helps the planet and your wallet by reducing energy usage and CO_2 emissions.

BioPCM™: A Smart Response To Climate Change

Imagine a product so smart it actively works to conserve energy and improve efficiency of buildings by maintaining comfortable room temperatures all day long. We all know traditional insulation works as a simple barrier that slows the transfer of heat. That's a good start, but scientists at Phase Change Energy Solutions have gone Beyond Insulation™ to develop phase change material technology that absorbs and releases excess heat as needed. The result? Buildings that stabilise at prescribed temperatures throughout the day, consuming less energy and keeping you more comfortable day & night.

BioPCM™: A Critical Difference

Years of study by independent laboratories have proven the effectiveness of phase change material. BioPCM™ uses a patented manufacturing method that enables low-cost bio-based materials to achieve significant energy savings and performance

BioPCM™ increases the comfort, safety and efficiency of buildings in several ways:

- reduces indoor temperature fluctuation
- reduces need for heating and cooling
- reduces greenhouse gas emissions
- improves safety and reduces fire risk
- reduces overall energy use
- shifts energy usage away from peak demand when energy can be most expensive

Earth Friendly, High Performance Green Building Material

Innovative Design, Simple Installation

BioPCM™ is encapsulated in flame retardant, super-enegineered polyfilm BioPCM™ and can be easily cut to fit around wall sockets, door frames and framing studs. BioPCM™ is placed along the interior wall directly behind standard plasterboard. Attic installation is a simple way to instantly gain energy savings.

This innovative design allows builders to creatively install BioPCM™ in entirely new construction, retrofit buildings and temporary structures. This flexibility encourages end-user innovation in taking advantage of BioPCM's energy storage properties.

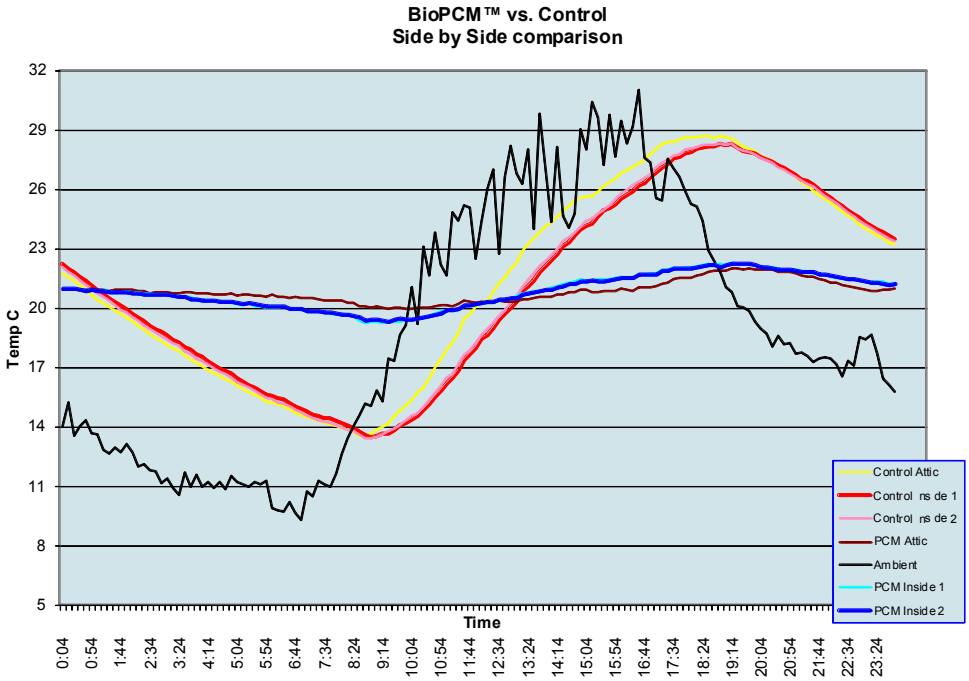
BioPCM™ is engineered to easily improve energy efficiency. Use in new construction or retrofit existing buildings to"Go Green" today.

How does it work?

How Does BioPCM™ Work?

BioPCM's patent-pending material absorbs and releases heat at pre-set temperatures. It is engineered around a fundamental properties of nature: the fundamental property of materials to absorb heat when they melt (phase change from solid to liquid) and to release heat when they solidify (phase change from liquid to solid). All materials exhibit this behaviour. BioPCM™ goes through this change at room temperature, absorbing and releasing heat in the process. These materials are referred to as phase change materials (PCM).

When BioPCM™ is placed in the structure of a building it absorbs heat (air conditioning / cooling) during the day and release heat back at night. This passively runs the energy cycle for energy efficientcy 24hrs a day. Less kWhs are used to heat and cool.



BioPCM ™ lowers energy usage, improves comfort, reduces our carbon footprint and is earth-friendly With BioPCM™ you can afford to do your part to help protect the planet.

BioPCM™ High-performance Smart Building Technology

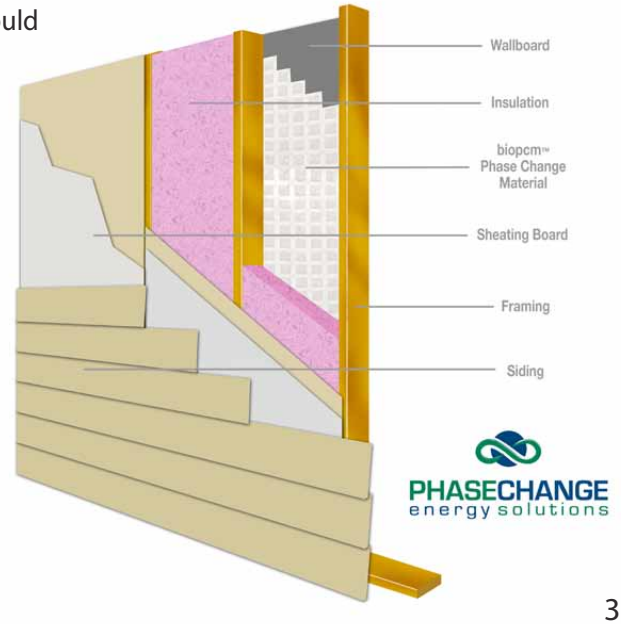
Ready to "go-green" quickly and easily BioPCM™ intelligently captures and releases otherwise wasted energy. BioPCM™ are used in new construction and for retrofitting existing structures.

Proof of Performance: Third Party Testing Confirms Energy Savings

Energy savings from BioPCM™ enables smaller, more efficient heating and cooling units to be installed. Some climates can completely eliminate mechanical heating and air conditioning. Direct savings are realised by reduced electric and gas utility bills and lower heating and cooling costs.

Fire Suppression: Turning Challenges into Opportunity

Phase Change Energy Solutions added a unique fire suppression element to BioPCM™ that actually works to help extinguish fire should fire occur in your structure.



Whether large or small, every homeowner can enjoy the benefits. BioPCM™ adds to your comfort and energy savings

Creating large energy reductions.

BioPCM™ is a User Friendly Product That Offers Endless Energy Savings

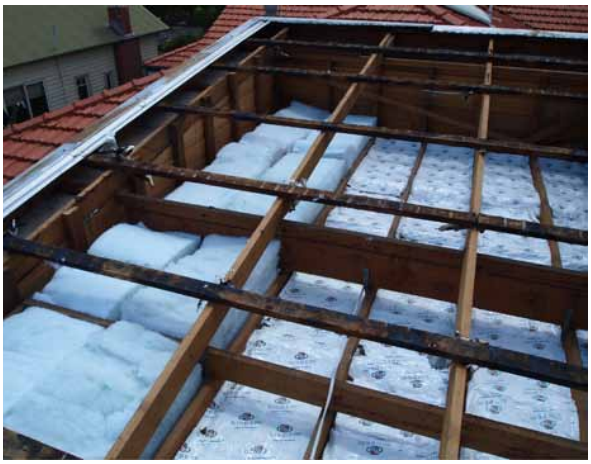
BioPCM™ is constructed of the highest quality eco-friendly materials. Easy installation allows commercial buildings to be retrofitted without traditional remodeling construction expenses and it enables even novice homebuilders to "go green".

Simply unroll the product and layer into the attic or attach to timber wall studs with a staple gun. This quick, easy process will save you money for years to come. Enjoy greater comfort and provide peace-of-mind to all those who are “green” minded.

BioPCM™ installation in a residential new construction environment. BioPCM™ is also a good solution for retrofit into existing structures, providing instant energy savings to the homeowner and commercial development.

Attach to a ceiling before panelling.

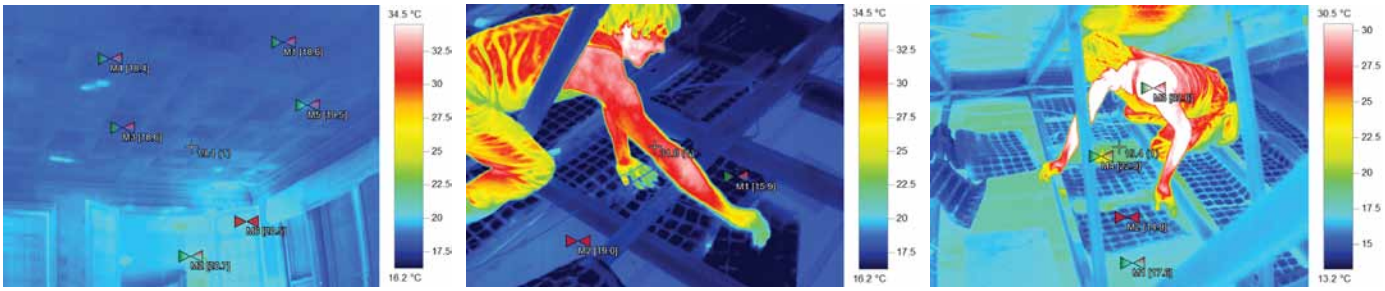
Attach to a wall before plastering.



Retrofit into an old roof.

Retrofit onto an old roof.

BioPCM™ through the eyes of a thermal imaging camera



BioPCM™ Questions & Answers

Q: What are PCMs?
A: Phase Change Materials (PCM) that change state from solids to liquids and liquids to gasses and back again. Enormous amounts of energy are absorbed and released in this process. This process reduces temperature fluctuations and makes buildings more stable, comfortable makes buildings more stable and energy efficient.

Q: Are there different types of PCM that are use in building?
A: Yes. BioPCM is made from renewable plant products, other technologies use petroleum based and salt based products.

Q: What energy does PCM use to change phase?
A: PCMs utilise latent heat. Latent heat is the amount of energy required to change matter from one state to another. In a Passive system, it is the natural heat that enters the building environment. In an Active System, ideally the heating or cooling comes from a mechanical system with a PV solar system; this allows you to make free energy, driving the HVAC system, and the ability to push and pull the BioPCM™ as required, utilising the product as a thermal battery.

Q: Is BioPCM™ a new insulation or a replacement for insulation
A: BioPCM™ is not intended to replace insulation; it is intended to complement insulation. All energy savings from BioPCM™ would be in addition to any savings from insulation. This is one reason why the addition of BioPCM to a structure is so effective.
Insulation works by increasing the thermal resistance of a building, slowing the flow of heat in an out of the structure. BioPCM™ works by increasing thermal mass, creating temperature stability. The combination of insulation and BioPCM™ works similar to a resistor and capacitor in an electrical circuit. The resistor (insulation) reduces the energy/heat flowing through the walls. The capacitor (BioPCM™) absorbs the excess energy/heat that makes it through and releases it when the energy level/temperature drops below the desired level.

Another analogy is: (1) Take a can of soda out of your refrigerator and place it on a counter. It will become room temperature quickly as it absorbs ambient heat. (2) Take the can of soda out of your refrigerator and place it into an insulated cooler without ice. It will become room temperature at a slower rate than when it sits on the counter because it is insulated. Essentially, this is us in our homes. (3) Take the soda out of your refrigerator and place it into an insulated cooler and add ice. The can of soda will stay cold as long as the ice can stay 0 °C. Think of BioPCM™ as room temperature ice that can keep you comfortable for a longer period than merely insulating you from the outside.

Q: How long will the product be affective?
A: BioPCM™ has been cycled through 87 years of life simulation in a laboratory and the performance has not been impacted.

Q: Where is the best place to install BioPCM?
A: In order to maximise efficiency, modelling shows the best place for BioPCM™ thermal mass is above you, so start with the ceiling; installation is simple, the product goes between the plaster board and the insulation (unlike insulation there is no requirement for the product to be tight, it just needs to be in), then the upper walls, about 1200m down from the top down.

Q: Will animals target this product as a food source?
A: Our products are not so much soy, palm-RSPO (Roundtable on Sustainable Palm Oil), or coconut oils, rather they are a WASTE PRODUCT from the food manufacturing process, that is performed to remove the acidic fatty esters. BioPCM™ uses these compounds. These esters are too acidic for consumption and contain no nutritional value for rodents. See rodent research (find in the 'Know More' section of the website).

Q: Can the product be installed into existing buildings?
A: There are many methods by which buildings could be retrofitted with BioPCM™ mats.
- Within the roof space /attic access, remove insulation, placing BioPCM™ mats between the ceiling joists or roof trusses right onto the plaster ceiling, then replacing insulation on top of the BioPCM™. Energy savings will be dramatic, since the ceiling is the most thermally dynamic part of any building.
- Steel buildings as part of a re-roof - baton out the old roof, placing BioPCM™ mats over the existing building roof, insulate and re-roof over the top. This will produce substantial energy savings, primarily because steel buildings have very little thermal mass.
- BioPCM™ mats are easily installed as part of a remodeling / refurbishment project when walls and ceilings are opened.

Q: How will BioPCM™ impact my utility bill?
A: Significantly. Some building designers are specifying BioPCM™ and doing away entirely with heating & cooling plants. For an older style home retrofit, BioPCM™ will do the majority of the heating and cooling heavy lifting demands and will move electric consumption to off peak hours when utilities cost are lower for electricity.

for electricity.

Q: What happens if the product is punctured?
A: BioPCM™ is a safe, biodegradable product that can be cleaned with soap and water. The product is designed to fit between wall studs and the product is fastened by its side flanges by staples to the timber studs. If any cells are damage in installation, those cells are easily cut out.

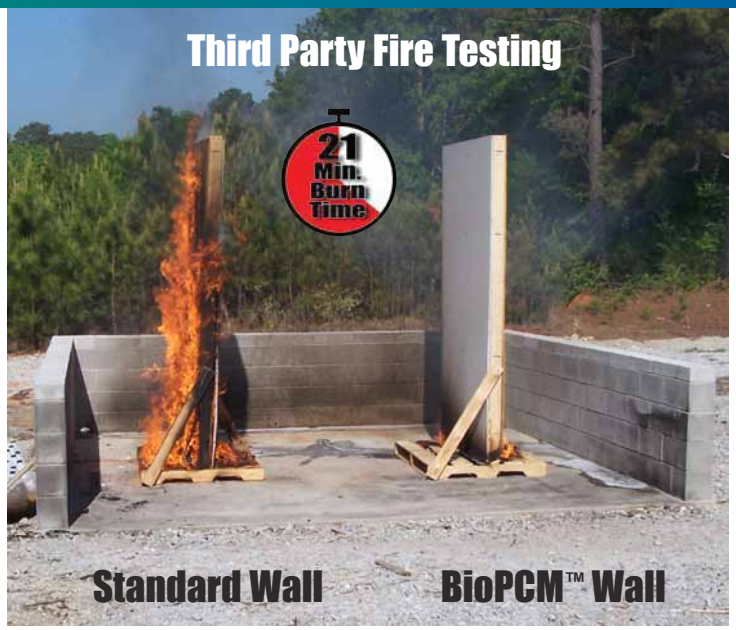
Q: What insulation is BioPCM™ recommended to be installed in conjunction?
A: BioPCM™ can be installed with all insulations.

Q: What is an example of latent heat effect
A: Latent heat is energy released or absorbed in a thermodynamic system, during a constant-temperature process. An example is a phase change transition, such as ice melting or water boiling. Ice cubes absorb the latent heat from the environment around a glass of water until the ice has Melted. Then that same glass of water placed into a freezer will return that heat energy until it becomes ice again. Notice that ice remains at 0 °C, BioPCM™ solid state is more expanded than water, the products frozen to solid range is from 18.5 to 23℃ and 21 to 25℃ within the human comfort range.

Save energy, save lives!

BioPCM™: A Closer Look At Fire Suppression

A major advantage of BioPCM™ is the fact that it saves you precious monetary resources year after year, but it also adds an additional layer of security to any structure. Our built in fire suppressant acts as a shield to extinguish most small fires. This adds critical extra minutes to allow occupants to escape larger fires. This factor can mean the difference between life and death and because the smoke index of any fire is often the leading factor in terms of a a positive out come. In independent, third party testing BioPCM™ recevied extremely high scores in reducing the the smoke index of fires. This means a significant reduction in the amount of deadly toxins released into the space which gives the occupants greater visual and breathing capacity.

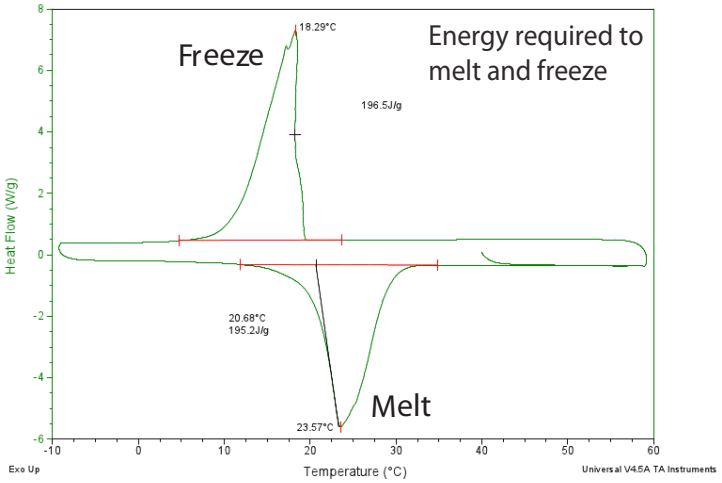


BioPCM™ is manufactured with your protection in mind, with a fire suppression element integrate to provide peace of mind The fire testing photo above shows the condition of a timber construction walls after a period of 21 minutes.

Constant temperature

Constant temperature means less HVAC run time

The window of temperature change over which a material freezes and melts is a measure of how successful that material is as a functional phase changing. BioPCM™ has a very narrow window of phase change from solid to liquid and back again over just a few degrees. The benefit is realised in both the cooling and heating cycle as the temperatures are within the human comfort band and is easily maintained.



Product Fire Testing

Tested to ASTM E84 Standards

ASTM International is one of the largest voluntary standards development organisations in the world-a trusted source for technical standards for materials, products, systems, and services. Known for their high technical quality and market relevancy, ASTM International standards have an important role in the information infrastructure that guides design, manufacturing and trade in the global economy.

Testing to these strict industry accepted standards is your confirmation that our products meet or exceed the safety guide-lines of the building products industry.

ASTM INTERNATIONAL
Standards Worldwide

It makes life more comfortable.

BioPCM™: Compared to other thermal contols

All materials exhibit thermal mass properties. So what makes BioPCM™ different?

BioPCM™ is versatile, it lends itself to many applications. BioPCM will greatly benefit comfort and lower energy consumption.

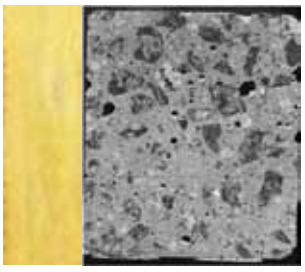
Concrete: continually adding heat to concrete will cause it to rise in temperature to uninhabitable levels. And continuing to remove heat will cause it to fall to uninhabitable levels. Concrete is a relative dumb thermal mass. More precise architectual and engineering designs are needed to successfully integrate concrete as a useful thermal mass. Even when concrete is integrated well people may use the building in a way that negatively effects the structure. BioPCM is more supportive and forgiving due to the temperature performance of phase changing.

Water: water is an excellent phase change material at 0°C. But at 0°C this is of little use for thermal control as there is no use for freezing temperatures in buildings. BioPCM™ is room temperature ice.

Insulation: slows down the rate at which heat leaves or enters a structure. To prevent the inside and outside temperatures form reaching each other, the building envelop must be constructed with good insulation. Insulation is an important partner to BioPCM™. Any excess heat that does make it through the insulation, windows and doors as well as gaps around the same gets absorbs and ultimately released by BioPCM™ intelligently.

1000mm of insulation is highly effective but impractical as our walls and ceiling spaces would need to be very thick.

1000mm

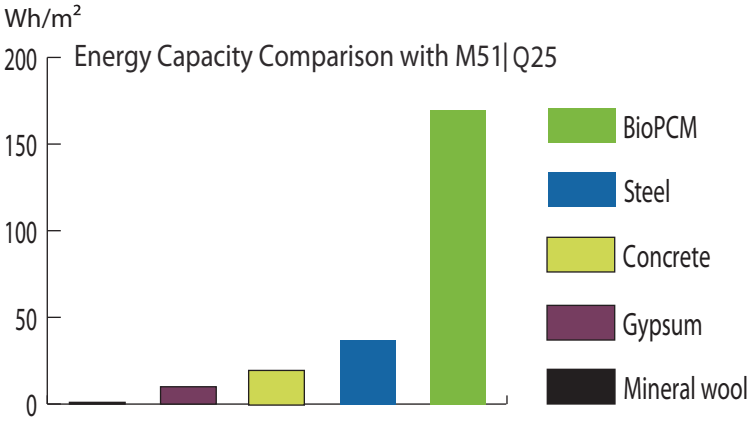


Insulation with concrete as a thermal mass is more practical, but follows average temperatures and it is heavy and can be costly to build with, especially as a ceiling product.

300mm

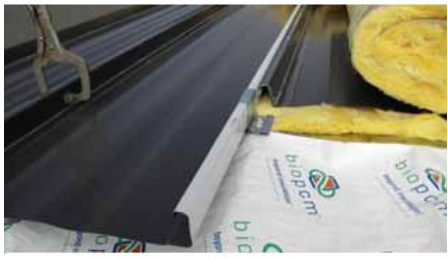
Insulation with BioPCM™ fits in a standard wall or ceiling. It's thermally active at room temperature, absorbing and releasing heat automatically. Comfort levels and energy bills are improved dramatically! Very light weight construction with smart thermal mass is now easily achieved.

90mm



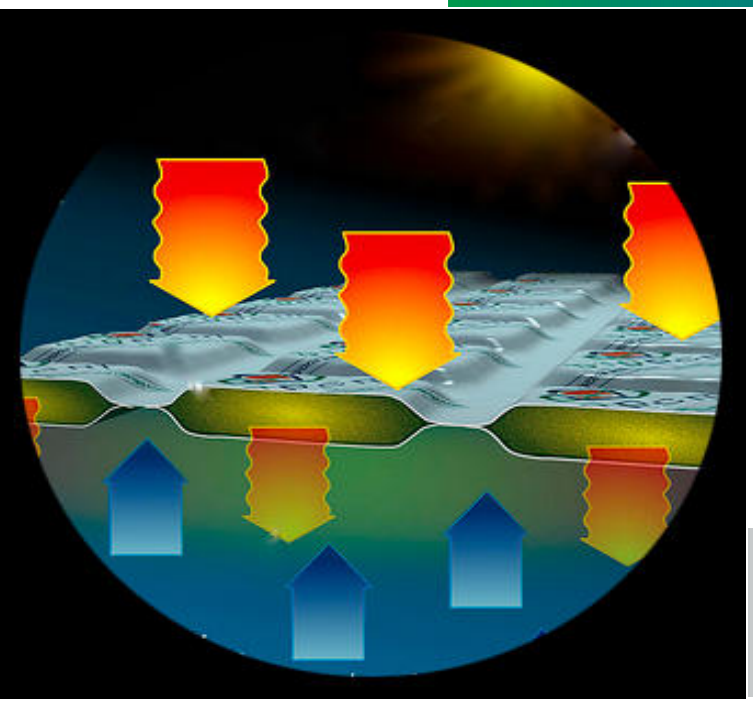
Product applications

- Restaurants
- Traditional Homes
- Modular Homes
- Commercial Box Stores
- Thermal Transport
- Warehouse Space
- Military Facilities
- Offices and Schools
- Churches/Synagogues
- Poultry/Agricultural Industry
- Unconditioned Light Industrial Space
- Remote Telecommunication Enclosures



bioPCmat™
beyond insulation™

High-performance energy savings that move the world BEYOND INSULATION™



Too hot? BioPCM™ absorbs excess heat.
Too cold? BioPCM™ releases stored heat.

The time is now.
Move BEYOND INSULATION™

To learn more about BioPCM™

www.arvio.com.au
info@arvio.com.au

03 9837 1050

International callers please call

+613 9837 1050

This brochure offers an overview of BioPCM™ applications. Please contact us to discuss your specific project. We offer a variety of customisable solutions designed for your specific needs.

Bio PCM™

BioPCM™ Mats	Units	23°C | 73°F Active Ingredient Weight 1.5 kg/sqm	23°C | 73°F Active Ingredient Weight 2.7 kg/sqm	23°C | 73°F Active Ingredient Weight 4.9 kg/sqm	25°C | 76°F Active Ingredient Weight 1.5 kg/sqm	25°C | 76°F Active Ingredient Weight 2.7 kg/sqm	25°C | 76°F Active Ingredient Weight 4.9 kg/sqm
Model		M27|Q23	M51|Q23	M91|Q23	M27|Q25	M51|Q25	M91|Q25
Total Product Weight per sqm	kg	2.59	3.76	6.44	2.59	3.76	6.44
Total unit thickness	mm	9	15	20	6	15	20
Dimensions (material width)	mm	450	450	450	450	450	450
Energy Store values							Other temps available
Melt point*	°C	23	23	23	25	25	25
Freeze point*	°C	18.5	18.5	18.5	21	21	21
Latent heat storage capacity	J/g >	165-200**	165-200**	165-200**	165-200**	165-200**	165-200**
Latent heat storage capacity	kWh/sqm >	0.085**	0.161**	0.287**	0.085**	0.161**	0.287**

* The temperatures shown in the products table are within close proximities of the "true" melting/freezing temperatures. Like all PCM, there is a small range that the PCM melts in. Please call or email if you have any questions, if your specifications require a different temperature, you need to know if the melting range covers your specifications or if you would like to discuss your potential application.

** Depending on formulation and application of product.

NOTE : All Phase Change Energy building products are tested to ASTM E84 standards

NOTE : Custom formulations for temperature and loading also available

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