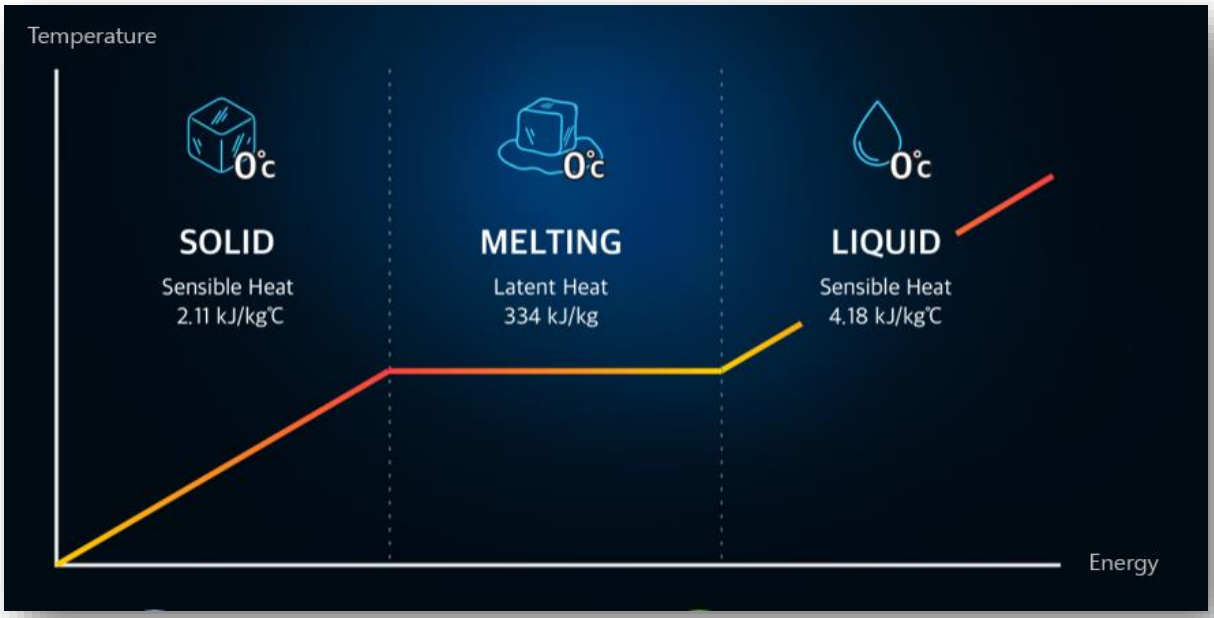
SPX Revolutionary Energy Saving Dryer Adopting Phase Change Material (PCM) technology

This revolutionary energy saving **PCM** Air Dryer is the result of more than 30 years' of continual product development efforts by JEMACO. Unlike the non-cycling Refrigerated Air Dryer which runs continuously regardless of the levels of air compressor loading, **SPX PCM** Air Dryer provides tremendous energy savings by adopting cutting edge technology. This technology harnesses the latent heat that occurs when **PCM** converts solid to liquid or liquid to solid, which automatically triggers the refrigeration compressor to switch on or off according to varying air compressor loads. **SPX** is revolutionising and setting the world's standard in the air dryer industry.

What is Phase Change Material (PCM)

Phase Change Material (**PCM**) is a material that harnesses the latent heat produced when **PCM** converts solid to liquid or liquid to solid.



For example, when 1 kg of ice adsorbs 2.11 kJ of heat, it will increase temperature by 1 °C and this heat is called ***Sensible Heat.*** When it reaches 0 °C, there is no temperature rise but it will change from solid phase to liquid phase. During this time, it is an isotherm process where 1kg of ice will adsorb 334 kJ of heat before it melts into water and this heat is called ***Latent Heat.*** From the above figure, latent heat for ice is 158 times of sensible heat of ice and 80 times of sensible heat of water!

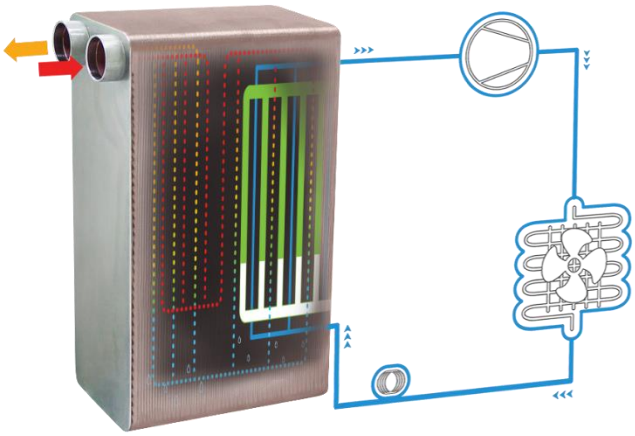
We are taking advantage of the huge amount of latent heat by choosing a phase change material which melts are 3oC and has latent of around 160 – 220 kJ/kg.

Latent Heat

Latent heat is energy released or absorbed by a body or a thermodynamic system, during a constant temperature process that is specified in some way. For instance, when ice melts into water, it absorbs heat from its surroundings. Vice versa, when water freezes into ice, the same volume of the heat is released. As such, when heat flows in and out at constant temperature, we call this heat as Latent Heat. We can see latent heat absorption when there is heat supplied, and latent heat desorption when heat is removed.

In general, Latent Heat value is much higher than Sensible Heat value. For example, Sensible Heat Value for water is 4.18KJ/kgC, but Latent Heat for changing ice to water at constant temperature of 0 ºC is 334KJ/kg which is 80times of water's Sensible Heat value.

SPX Phase Change Material (PCM) Refrigerated Air Dryer



SPX PCM dryer's stainless steel brazed plate heat exchanger is manufactured at its own Stainless Steel BPHE manufacturing facilities in Busan, enabling full quality control internally.

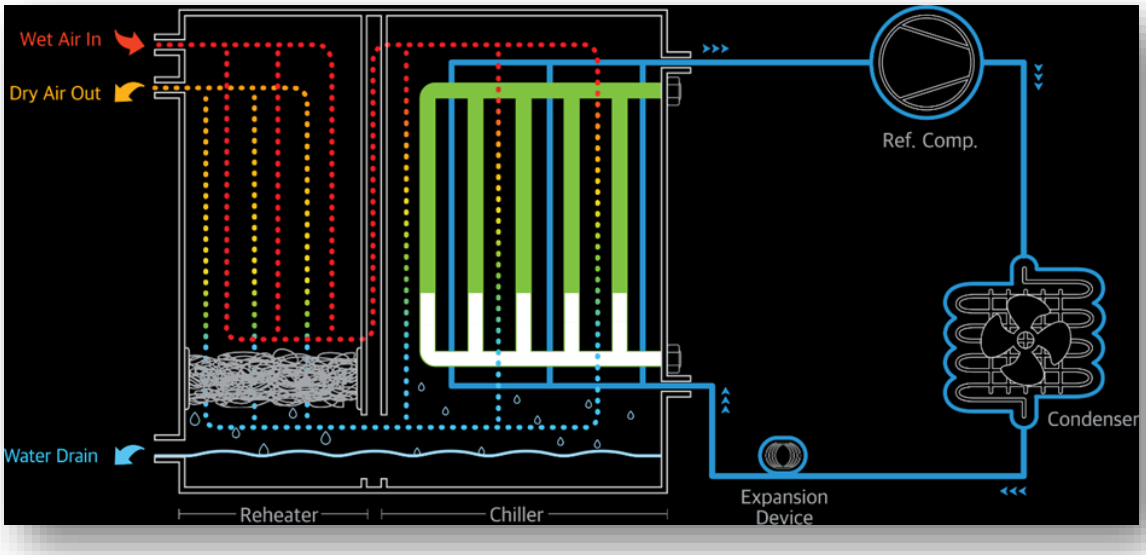
How it works

PCM Series Flow Diagram

Phase Change in PCM Dryer

1. When the refrigeration compressor and the condenser fan are running, the cold refrigerant
2. in the chiller (evaporator) cools the liquid Phase Change Material (PCM) which gradually solidifies.
3. When PCM is sufficiently cooled and solidified, the refrigeration compressor and condenser fan will stop.
4. The compressed air is continuously cooled by PCM while the refrigeration compressor is inactive. No power is consumed during this period.
5. The PCM gradually liquefies as it adsorbs heat from the compressed air, and when fully melted, the refrigeration compressor and condenser fan resume to cool the PCM.

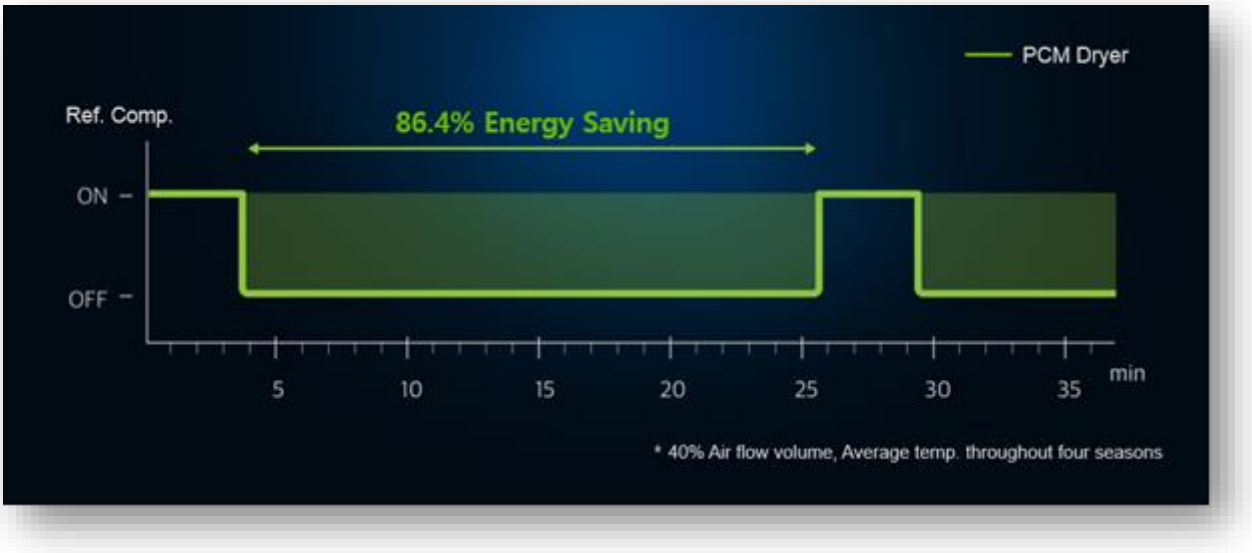
How the dryer works



1. Compressed air saturated with water vapour enters the stainless steel brazed plate air-to-air heat exchanger. It is pre-cooled by the outgoing chilled air, and then directed to the stainless steel brazed plate **PCM-to-Air** heat exchanger (evaporator) where it is further cooled by the innovative Phase Change Material (**PCM**).
2. As the air is cooled, water vapour condenses into liquid droplets which are then removed by high efficiency integral water separator, sending dry air into the Reheater.

3. The chilled dry air returns through air-to-air heat exchanger (Reheater) where it is reheated before exiting the dryer. This process is essential in order to prevent external sweating of piping when clean and dry compressed air travels to point of use.
4. Water droplets from the integral separator are then removed by an automatic electronic drain.

How Can PCM Dryer Saves Energy

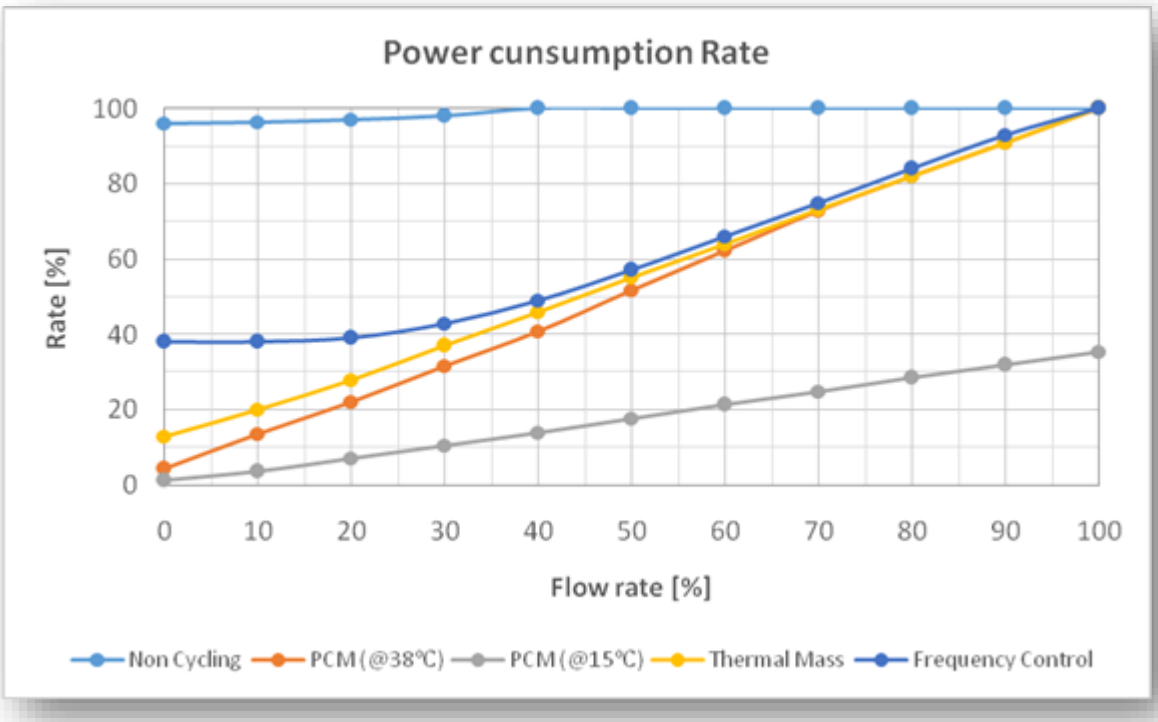


When the phase change material (**PCM**) solidifies, the refrigerant compressor stops.

For example, when the dryer is running at 40% of inlet flow and average temperature for four seasons, ie 12.5 ºC , there is 86.4% energy saving. This means the refrigerant compressor runs for 3.5 minutes and stops for 22.5 minutes, total cycle of 26 minutes.

By reducing power consumption and maximising life span of the refrigeration compressor through the extension of off cycle during low loads or partial loads. The lower the air compressor loads, the more energy savings.

How energy efficient is SPX PCM dryer compared to other types of dryer?

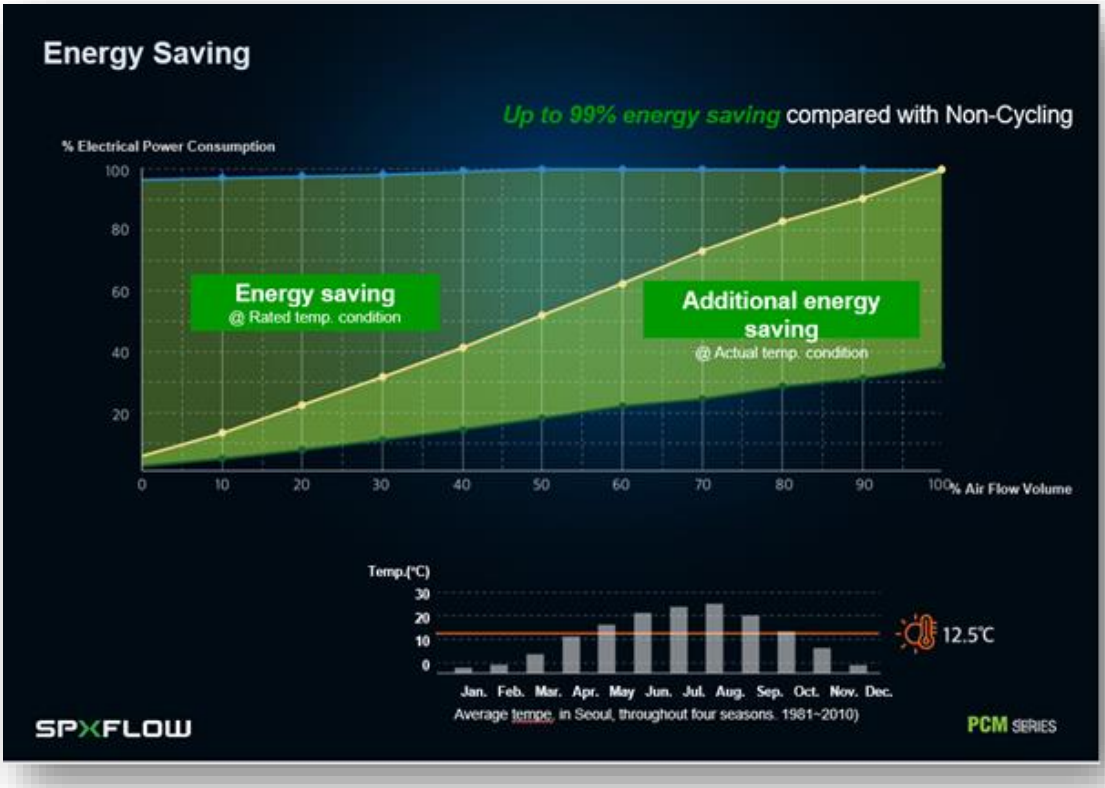


The above chart shows energy consumption of different types of refrigerated dryer.

For **non-cycling dryer**, it still uses 96% of energy during no load condition .

We also compared various types of cycling dryers such as :

1. *Frequency contro*l – this dryer still requires 38% of energy when there is no load because the refrigerant compressor still running.
2. *Thermal Mass Dryer* – this dryer still requires 13% of energy when there is no load
3. *SPX PCM Dryer* at 38 °C utilizes only 4.3% of energy at no load
4. *SPX PCM* Dryer at 15 °C – there is even more saving at lower ambient temperature which only utilizes 1.2% of energy at no load
5. This is a great breakthrough in technology and so far one of the best performance in the energy saving machines.



There is extra advantage with the **SPX PCM** dryer when it is operating under low ambient condition. We have tested the dryer at 15 °C ambient temperature, it draws less power compared to operating under 38 °C at the same inlet flow.

For example, at 100% loading, it draws 100% of power at 38 °C but only draws 35.5% of energy at 15 °C ambient temperature.

For example, at 50% loading, it draws 51.8% of power at 38 °C but only draws 17.7% of energy at 15 °C ambient temperature.