

Moisture Control

Rebound Technologies, 2024

SUMMARY.

IcePoint technology harnesses ice as a versatile medium—acting as a heat transfer fluid, storage material, and refrigerant. As a storage material, ice achieves lower dew points than conventional dehumidifiers, allowing efficient moisture control. In a freeze point suppression cycle (Rebound's patented invention from 2012), ice can reduce dew points to as low as -40°F . This technology enables moisture management using off-peak energy, handles high moisture bursts with smaller equipment, and operates without natural gas, thus avoiding Scope 1 and 2 greenhouse gas emissions.

PSYCHROMETRICS.

Systems with IcePoint at their core are particularly well suited for moisture management duties both below and above freezing. This feature enables significant value creation in applications like cold storage, food processing, agriculture, natatorium (pools), chemicals, and manufacturing markets where moisture control (latent) loads can often outweigh temperature reduction (sensible) loads.

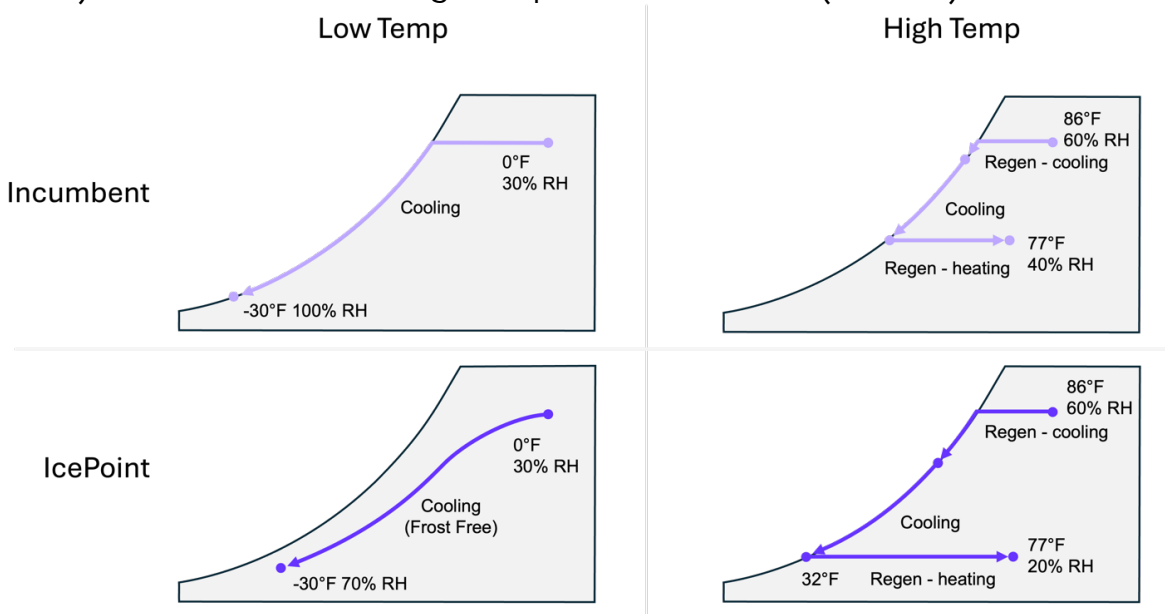


Figure 1: Psychrometric charts for low temperature (blast freezing as an example) and high temperature (natatorium as an example) moisture control applications showing performance for both traditional incumbent mechanical cooling and IcePoint enabled products.

In a high temperature application like the agriculture, natatorium, and manufacturing verticals, IcePoint enabled systems have an advantage over traditional systems due to their ice-based storage and working fluids. Using low cost off peak energy, these systems generate and store ice to be used later. This ice naturally produces chilled water at a temperature just above freezing, making it the ideal moisture control agent: the chilled water produced can remove the maximum amount of moisture from the air, but inherently cannot form frost in whatever system is being used to remove moisture from the conditioned space. Incumbent systems, on the other hand, must operate at higher moisture removal temperatures to both avoid making frost and keep efficiency high. This makes these system far less effective: for the same air inlet conditions, and IcePoint enabled system is able to reach significantly lower relative humidities. **For example, in a natatorium application where an incumbent can produce a relative humidity of 40%, and IceCase enabled system is able to deliver 20% relative humidity air without any sophisticated anti-frosting controls, or defrost equipment required.**

In a low temperature (or low dewpoint) application like blast freezing, cold storage, battery manufacturing, or ice-skating rinks, IcePoint enabled systems can remove moisture directly from the conditioned space using non-toxic, non-flammable, non-corrosive brine. As shown in Figure 1 this process avoids the condensate / frost line entirely because of the brine's low activity. Instead, the direct contact between the brine and air maintains a relative humidity around 70% as the air cools, leading to a final condition with a low dew point. With proper recuperation, this process can produce low temperature or high temperature air at a very low dewpoint without the need for concentrated or corrosive brines or desiccant regeneration via natural gas combustion.

APPLICATIONS.

Moisture control is a critical challenge in various applications, where excessive humidity can compromise efficiency, safety, and product quality. IcePoint technology offers an innovative solution by using ice as a versatile medium for dehumidification, cooling, and moisture management. This approach delivers superior performance compared to conventional methods, providing energy-efficient and precise control over moisture levels. Below, we explore how IcePoint technology enhances moisture control in diverse applications such as natatoriums, blast freezing, food processing, and battery manufacturing, resulting in improved operational efficiency and reduced energy costs.



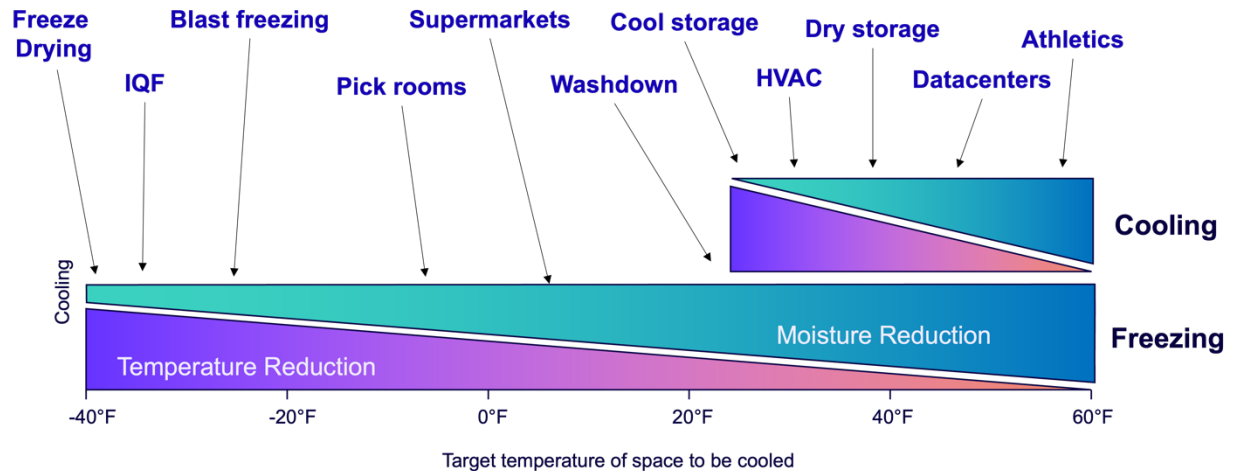


Figure 2: IcePoint enabled technologies can provide value across the HVAC temperature spectrum.

Here's a more detailed explanation of how IcePoint technology aids moisture control in different applications:

1. **Natatoriums:** IcePoint technology effectively manages the high humidity generated by indoor pools, maintaining a comfortable environment at peak occupancy without oversizing equipment. It reliably lowers dew points and minimizes condensation, helping protect infrastructure from moisture-related damage.
2. **Blast Freezing:** In blast freezers, IcePoint technology reduces frost accumulation on coils, a significant issue since frost acts as an insulator that restricts airflow. This technology helps maintain consistent airflow, improving freezing efficiency and preventing productivity losses, which can otherwise drop by 20-50%.



Figure 3: (left) a coil before frost formation. (right) a coil after a few hours of operation covered in frost that is inhibiting process efficiency.

3. **Food Processing:** After washdown procedures in food processing, IcePoint technology expedites moisture recovery with significantly smaller equipment, allowing faster return to production. This results in improved uptime and significant financial benefits, as every hour saved means increased production capacity and revenue.
4. **Battery Manufacturing:** In battery manufacturing, precise moisture control is crucial to ensure product quality. IcePoint technology provides stable, low-humidity conditions, essential for preventing moisture-related defects in sensitive battery components. This leads to higher product consistency and fewer manufacturing disruptions without the natural gas, cost, and carbon emissions associated with normal desiccant wheels.