Biomass Powered Absorption Chiller For Refrigerated Warehouse

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Refrigerated warehouses preserve perishable food with energy-intensive refrigeration.

Biomass is a ubiquitous byproduct of producing food.

The circle of sustainability is closed when the refrigeration for preservation is produced by a biomass powered absorption chiller.

A recently launched project does that. In the Philippines, rice husks are burned to provide heat to an ammonia absorption refrigeration unit ("Thermochiller"). At full load, 300 kg per hour (12 pounds per minute) of rice husks are burned to make 8.5 bar (110 psig) steam. The steam powers the Thermochiller, which produces 280 kW (80 tons) of refrigeration at -30ºC (-22ºF).

At the first location (Mamplasan), the cold is transferred from the Thermochiller to the storerooms by pumped ethylene glycol (50%). At a second location pumped 20% aqua ammonia will be used, which is appreciably more energy efficient, primarily due to much lower viscosity. Ultimately it is planned to use pumped saturated CO2, which also saves both pumping power and capital.

The biomass powered Thermochiller reduces the electric demand by 85%. In addition, the ultimate in sustainability is achieved due to the ammonia-water working pair, which has zero ozone depletion potential and zero global warming potential.

The Thermochiller ammonia absorption refrigeration unit was developed and built by Energy Concepts Company of Annapolis, Maryland. The TC80 Thermochiller is an advanced proprietary design. The Coefficient of Performance has been increased to 0.45 to minimize rice husk consumption. The ammonia charge has been reduced to 0.5 kg per kW to increase cold store safety. Compared to conventional ammonia chillers, that is an 85% reduction in ammonia charge in addition to the 85% reduction in electricity.

The project developer is CUBES (Concepts Unplugged: Business Environment Solutions) Inc. CUBES installs, operates and maintains the refrigeration equipment under contract to the refrigerated warehouse owner.

The reduced electric demand of the biomass powered Thermochiller is especially important in developing economies, where electricity is in chronic short supply, and demand for refrigerated storage is growing rapidly.

Many types of biomass can be used, including bagasse, corn stover, sawgrass, wood chips, bark, etc. Biogas powered Thermochillers can be used at animal growing operations. Other sustainable heat sources to power the Thermochiller include waste heat from CHP systems, and solar thermal heat.

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Three Views of TC80 Thermochiller Ready for Shipment

Feeding Rice Husks into the Biomass Boiler

Cold Storeroom Refrigerated by Rice Husks

The Biomass Powered Thermochiller Team from CUBES