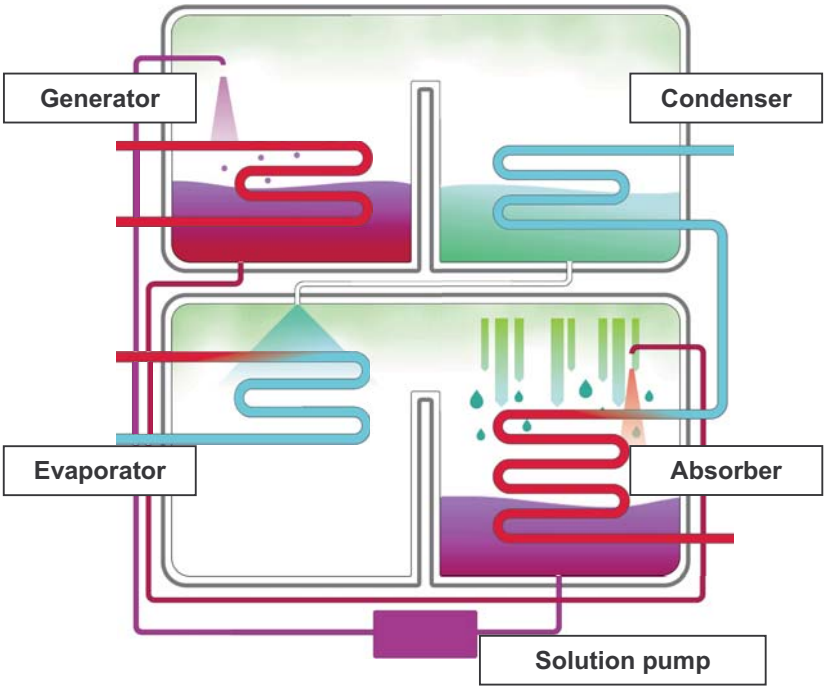
“District Cooling”: Yazaki Aroace Absorption Chillers Generating Cooling from District Heat in Summer Season

1. How Absorption Cooling works



The energy source heats a dilute lithium bromide solution in the generator. This boiling process generates the refrigerant vapor and thereby concentrates the lithium bromide solution. The refrigerant vapor then flows to the condenser.

In the condenser, refrigerant vapor from the generator is condensed on the surface of the cooling coil and condensation heat is removed by the cooling water. Refrigerant liquid accumulates in the condenser and then passes through a narrow channel into the evaporator.

Pressure in the evaporator is close to a vacuum, forcing the refrigerant liquid to flow from the condenser into the evaporator. Here it easily boils on the surface of the chilled water coil. At this point the evaporative latent heat of the refrigerant is removed from the chilled water, decreasing it from 12°C to 7°C. The refrigerant
vapor flows to the absorber.

A low pressure in the absorber is maintained by the affinity of the concentrated lithium bromide solution from the generator with the refrigerant vapor formed in the evaporator. The refrigerant vapor is absorbed by the concentrated lithium bromide solution as it flows across the surface of the absorber coil. Heat from condensation and dilution is removed by the cooling water.

The solution pump conveys the dilute lithium bromide solution from the absorber back to the generator.

2. District Power Station or Industry

The waste heat from district power station or factory etc. is useful energy to drive the absorption cooling machine. Usage of waste heat can drastically reduce the consumption of electricity required for cooling purposes. This is one of the most appropriate energy saving methods for factories etc.

Characteristics of waste heat from district power station or industry applications:

- Driving energy is provided as waste heat from existing factory manufacturing process heat etc.
- Significant operating cost savings through the use of existing heat sources for air conditioning and/or process cooling
- Low electrical consumption for an absorption cooling machine, thus alleviating strain on electricity grids by replacing conventional demand peaks for cooling purposes

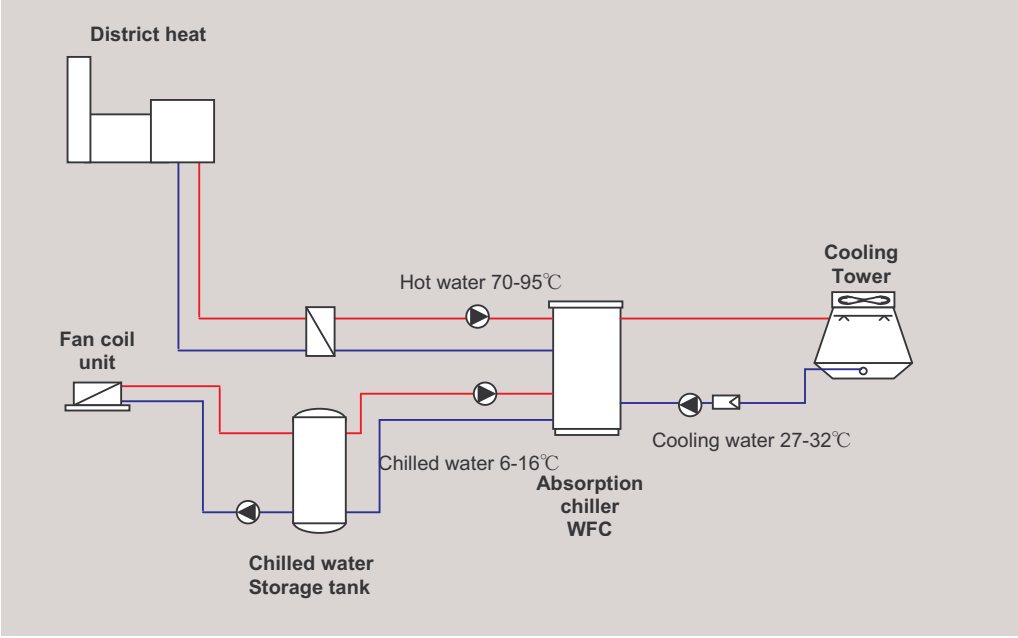
Points to consider:

The most important point of cooling by waste heat from district power station or factory etc. is how the chiller can utilize waste heat continuously to make the system effective.

Chilled water storage tank:

The continuous operation of the WFCs increase the waste heat usage ratio and maintain the high efficiency of the cooling capacity. Please consider to install the chilled water storage tank for the leveling fluctuation of the cooling demand.

Typical system diagram



3. “District Cooling” in Practice:
Yazaki Aroace Absorption Chillers Providing Cooling from Waste Heat in a Hotel in Basel (Switzerland)

Ibis Hotel (Accor-Group) in Basel Switzerland

Project

From January 1st 2004 all cooling and air-conditioning equipment with a refrigerant volume above 3 kg must be approved by the local authorities. Alternative cooling solutions such as absorption are spared from that regulation. In order to avoid lengthy approval procedures, the owner already decided during the project’s development stage to use the existing district heating of the Basel municipal utilities (Industrielle Werke Basel (IWB)) in order to generate cooling (within the territory of IWB connection to heating systems is mandatory). The IWB promotes district heating fired thermal cooling by attractive tariffs and special subsidy programs which compensate the higher investment costs vis-a-vis conventional compression cooling.

Task

The main task for the planner was to realize a lean and efficient as well as sustainable heating and cooling system serving the needs of a 2-star-economy Hotel. Due to the climatic challenges in Basel (river Rhine valley), dehumidification played a major role in the overall climatization concept. Also local charges in regard to noise protection and visual appearance were decisive criteria for designing the recooling on the hotel roof.

Solution

- Rooms: individually controllable ceiling-integrated fan coil/ heating units
- Dehumidifying base ventilation with double air exchanger
- Connection to district heating (220 kW)
- Connection to district heating for cooling (150 kW)
- 1 Yazaki Aroace absorption chiller, WFC-SC-30,cooling capacity 105 kW (max. 140 kW) Hot water volume flow rate varying between 30 – 100 %
- 1 cooling tower, adiabatic, (250 kW) with extra low noise, RPM-controlled ventilators and low RPM for night operation
- Chilled water cycle storage tank (2.000 l)
- A control that allows for a demand-oriented chiller operation in the range of 30-100%.

Technical Data of the installed Yazaki Aroace absorption chillers

Type WFC-SC 30
105 kW cooling capacity (max. 140 kW)
Heating medium cycle 88 °C to 83 °C (Inlet: min. 70 °C / max. 95 °C)
Hot water volume flow rate varying between 30 and 100 %
Chilled water: 12.5 °C inlet, 7 °C outlet
Cooling water inlet: 31 °C to 35 °C
COP: 0,7