

# **ADVANCED ABSORPTION CHILLERS**

## **UTILIZATION OF VARIOUS HEAT ENERGIES FOR AIR- CONDITIONING**

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### **Summary**

One of significant feature of absorption cooling technology is that various thermal energies can be used for air-conditioning by the technology. The main types of thermal energy are hot water, steam, and exhaust gas. In this document, Yazaki's advanced absorption chillers and systems are introduced for effective usages not only waste thermal energies but also renewable energies.

### **1. Utilization of Various Waste Thermal Energies**

By an onsite electrical generator and manufacturing process of factory, various types of thermal energy are discharged, such as hot water, steam, and exhaust gas. Absorption chiller can use not only fossil fuel but also the waste thermal energies for cooling. In combination with an electrical generator and an absorption chiller, the combined system can improve overall efficiency rate by using the waste thermal energy for cooling. For effective utilization of energy, Yazaki provides absorption chillers for each type of thermal energy.

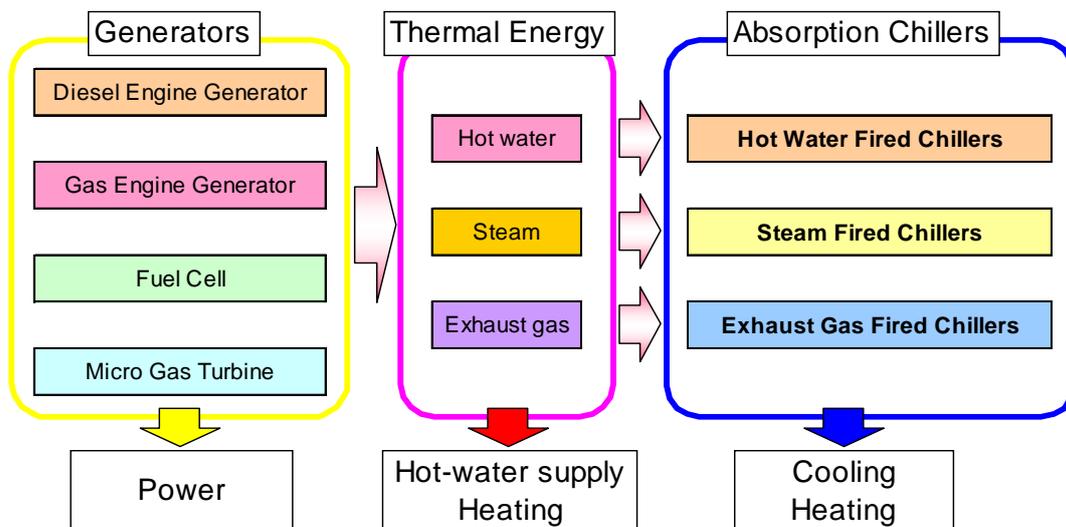


Figure 1. Type of Waste Heat and Absorption Chillers

## 2. For Utilization of Hot Water

Hot water Fired Chiller (WFC) is the first type of chiller for utilizing waste heat. The WFC absorption cycle is energized by hot water and the lower side operational temperature range of hot water is expanded to 70 degree C for effective utilization of the thermal energy.

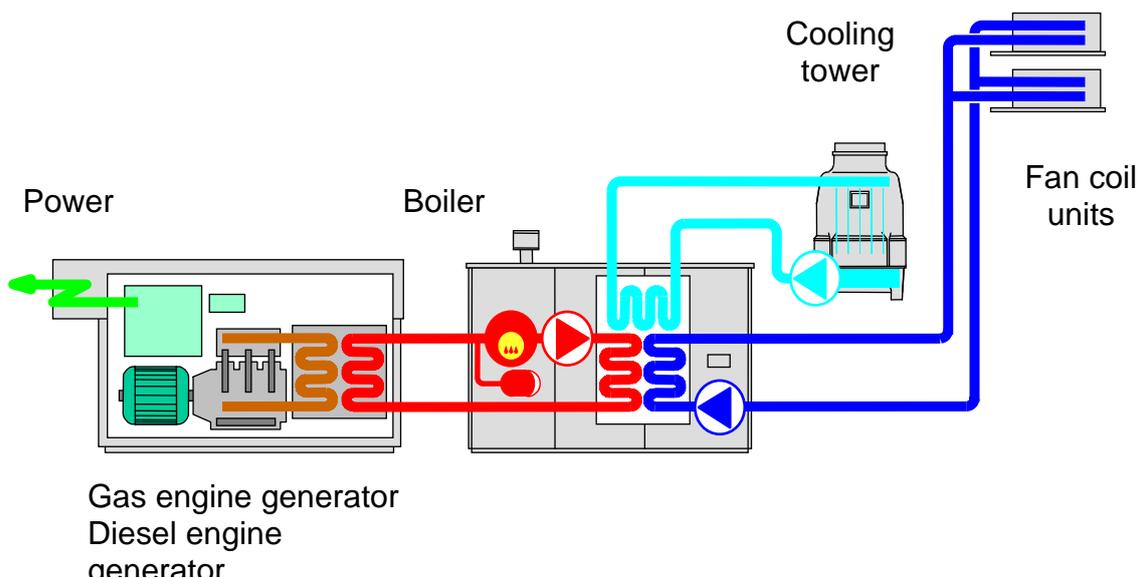


Figure 2. Co-generation System with WFC-SCB or WFC-SHB

In general, if the hot water temperature is not enough to operate the WFC, additional boiler is installed into the system to produce an increase in temperature. WFC-SCB and WFC SHB series are the packaged type of auxiliary boiler. By optimal control of auxiliary boiler and WFC, waste energy of hot water can be used effectively.

### 3. For Utilization of Steam

CH-KGST can use wasted steam for cooling. In the case of high-pressure steam, the CH-KGST operates double effect cooling cycle. If the steam pressure decreases, the CH-KGST cooling cycle switch to single effect cooling cycle. By the cycle switching control, CH-KGST series can operate continuously under steam pressure fluctuation from 98 kPa to 686 kPa and realizes effective use of low-pressure steam.

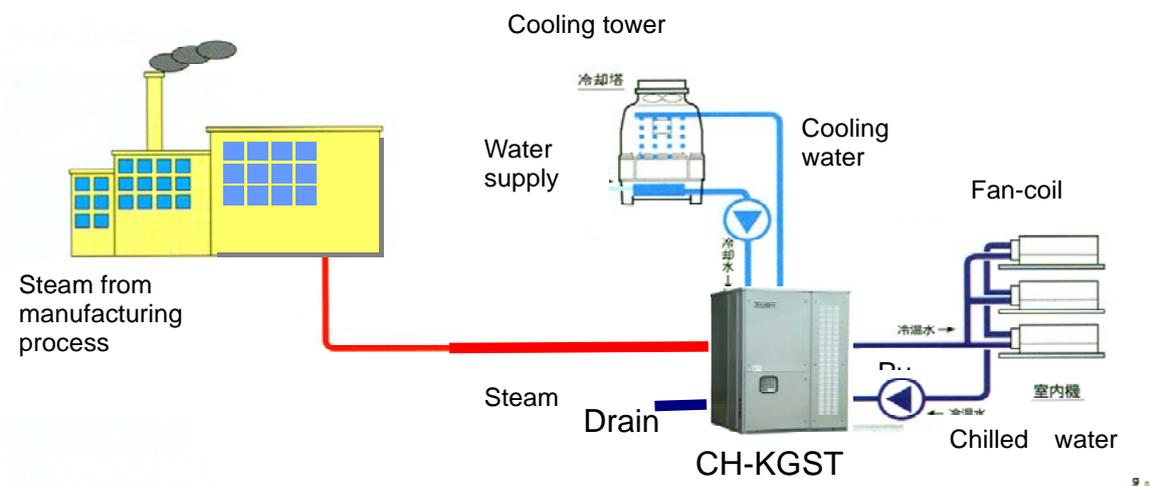


Figure 3. Steam Fired Absorption Chiller-Heater – CH-KGST series

#### 4. For Utilization of Exhaust Gas from MGT

CH-KE series can use exhaust gas from MGT directly. The exhaust gas thermal energy retrieved by exhaust heat exchanger and exhaust heat retriever to achieve high efficiency operation. Exhaust gas operation takes priority whenever there is sufficient exhaust heat available in respect of the cooling or heating load. When exhaust gas mode as a function of electrical demand is not sufficient to satisfy cooling or heating requirement, dual fuel mode, exhaust gas and natural gas, will automatically commence. 100% direct gas fired mode will cater for cooling or heating demand when there is little or no heat available from the micro gas turbine.

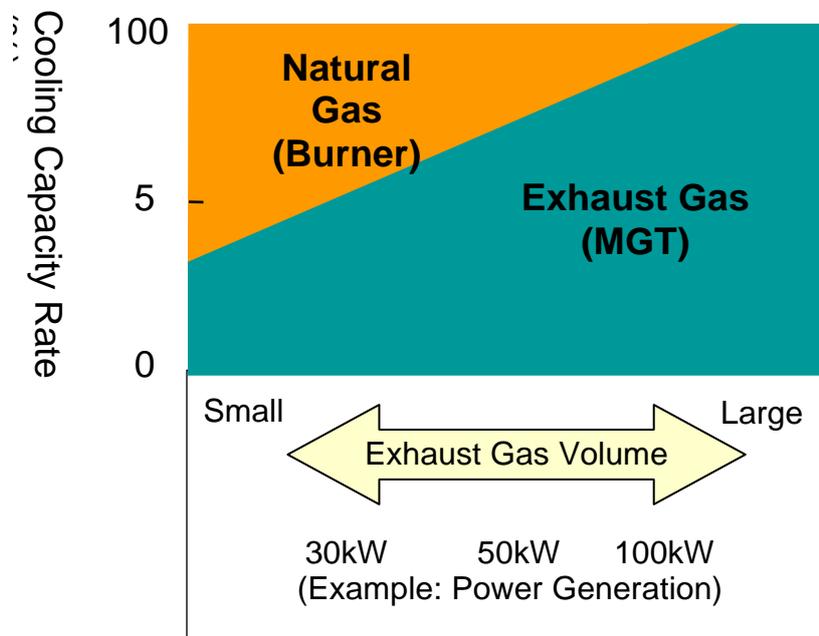


Figure 4. Reference Image of Exhaust gas Operation Priority

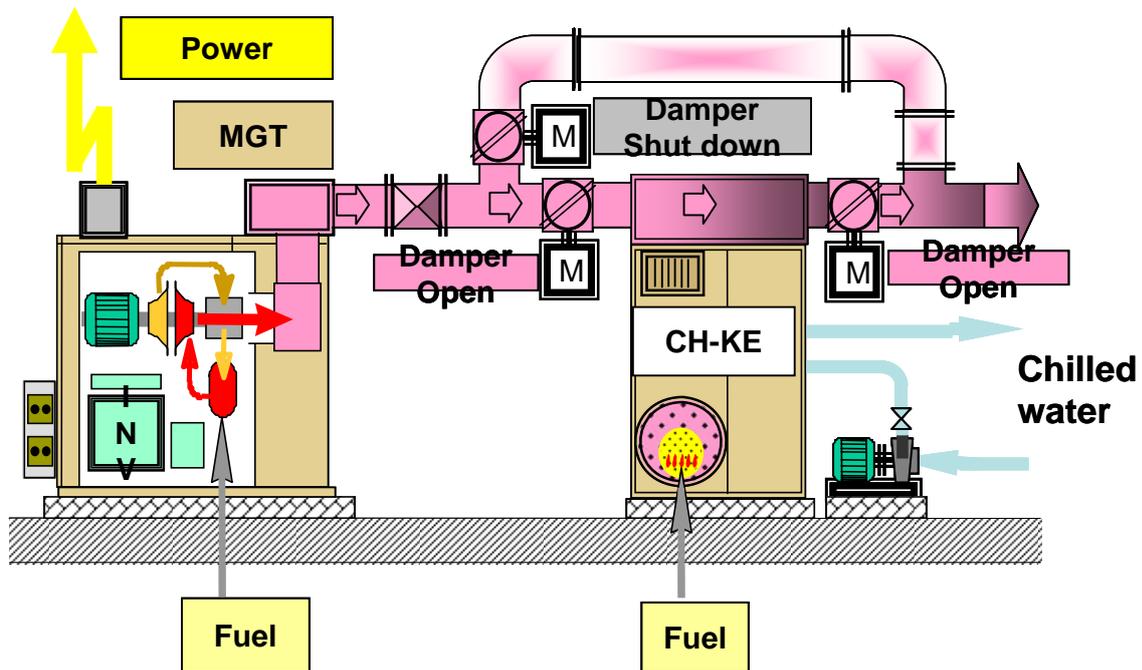


Figure 5. CH-KE System with MGT

## 5. For Utilization Renewable Energy

### 5.1 Solar Thermal Energy

In July 1974, Yazaki Experimental Solar House was completed, realizing a solar energy system earlier than any other project in the world. The success of development solar energy system is based on Hot-water Fired Chiller (WFC) technology. The WFC series has been installed 3,851 projects in Japanese market.



Figure 6. Yazaki Experimental Solar House

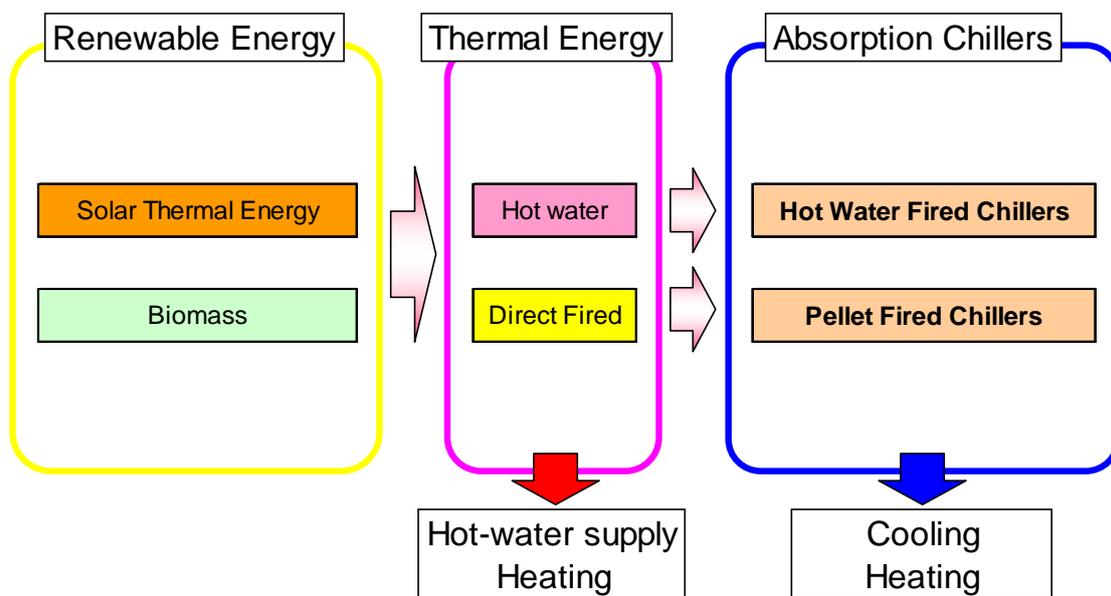


Figure 7. Utilizing Renewable Energy

## 5. 2 Biomass Energy – Wood Pellet

Fig 8 indicates the Pellet Fired Absorption Chiller, which is energized by wood pellets. The Wood pellet Fired Absorption Chiller-Heater is under development and it will launch to Japanese market in 2007.

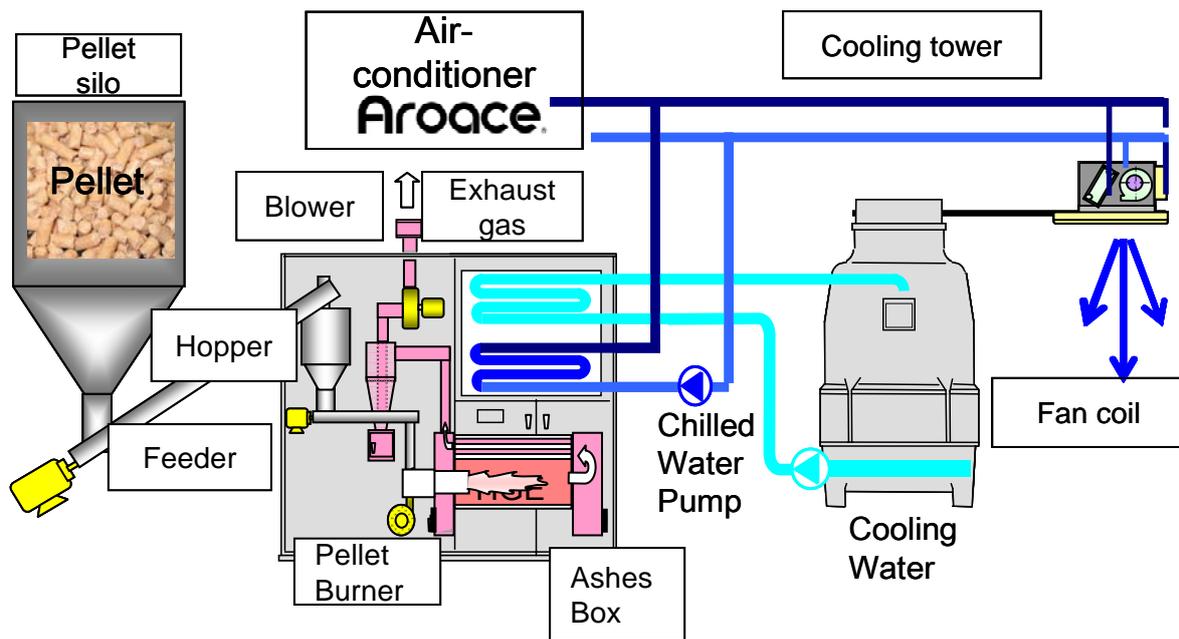


Figure 8. System of Pellet Fired Absorption Chiller-Heater

Using wood pellet as fuel is considered as “Carbon-neutral”. Since tree planted to replace the wood burned as fuel can absorb carbon dioxide, this resource has attracted interest as a carbon-neutral fuel, that is, one which does not increase the amount of carbon dioxide in the atmosphere.

The model business, which is indicated Fig 9, in local recycling of wood biomass involves collecting thinned wood from forestry maintenance operations, wood cut-off from sawmills, and other remnant material and recycling them into pellets for local use as fuel. By doing so, the scheme aims to promote the principle of local production for local consumption in timber and energy supply through efficient use of forestry resources. The Yazaki Group is working in the framework of public-private partnership with the aim is to stimulate the forestry industry and at same time to maintain and preserve forests and reduce atmospheric carbon dioxide.

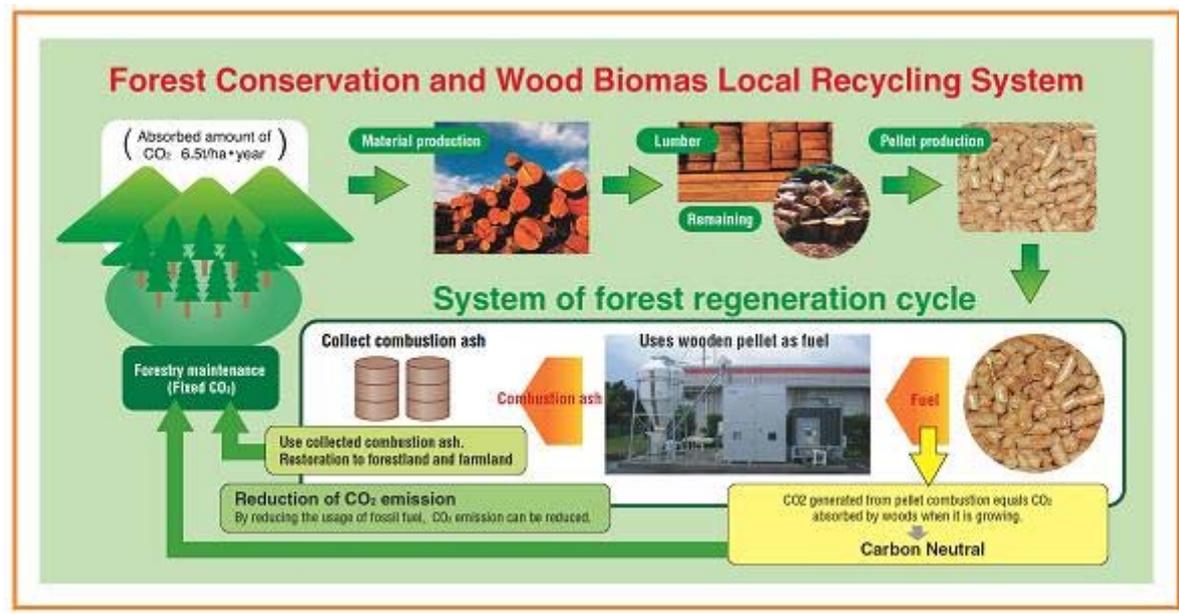


Figure 9. Wood Biomass Local Recycling System

Fig 10 is one of “Renewable Energy Utilization Cooling System” which is consisted by solar cooling system and wood pellet cooling system. During daytime, if sunlight is enough to sufficient cooling requirement, solar cooling suffices cooling requirement without wood pellet absorption chiller operation. If there is less sunlight, the wood pellet can cover insufficient cooling capacity of solar cooling during morning and evening time or cloudy day.

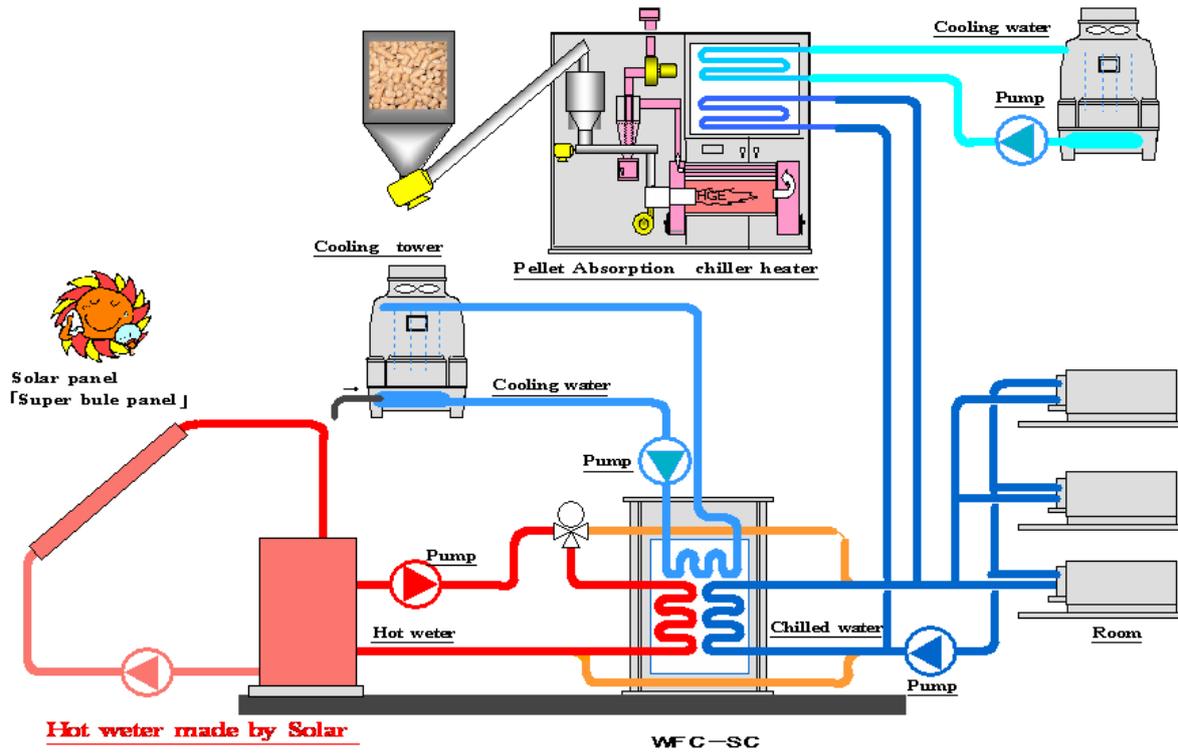


Figure 10. Renewable Energy Utilization Cooling System

