

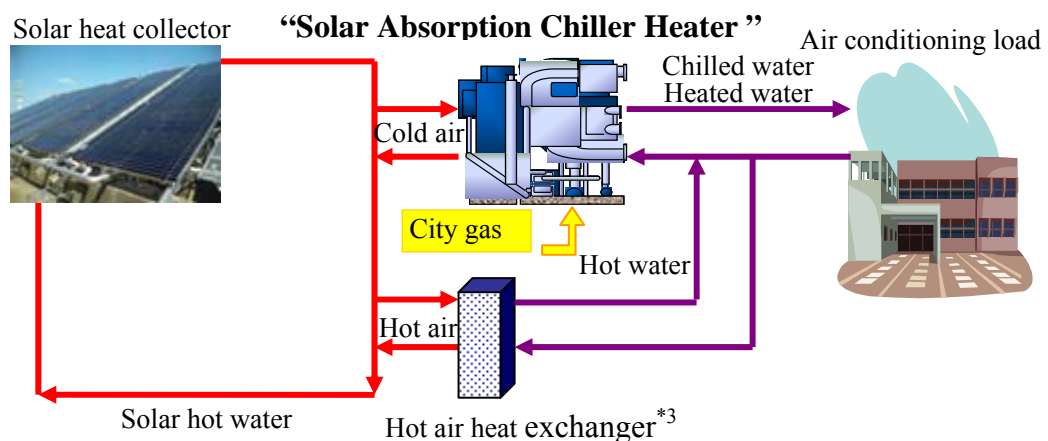
## Development of New Solar Absorption Chiller Heater Commercial Air Conditioning System Makes Efficient Use of Solar Heat

Tokyo Gas Co., Ltd.  
Osaka Gas Co., Ltd.  
Toho Gas, Ltd.

The three city gas companies Tokyo Gas Co., Ltd. (President: Tsuyoshi Okamoto) Osaka Gas Co., Ltd. (President: Hiroshi Ozaki) and Toho Gas Ltd. (President: Takashi Saeki) have developed a new solar absorption chiller heater. This is a commercial air conditioning unit which cools the air using heat collected from the sun. The new solar absorption chiller heater was jointly developed by the three city gas companies together with the manufacturers Kawasaki Thermal Engineering Co., Ltd. (President: Kazutoyo Daikoku; hereafter “Kawasaki Thermal”), Sanyo Electric Co., Ltd. (President: Seiichiro Sano; hereafter “Sanyo”), and Hitachi Appliances, Inc. (President: Takazumi Ishizu; hereafter “Hitachi”).

The new product is an air conditioning unit specially designed to utilize solar heat. The solar heat is used on a preferential basis with gas as an efficient backup for rainy days and other times when the solar heat is insufficient, to maintain comfort and convenience and pursue environmental performance. Commercial air conditioning systems (solar cooling systems) – which combine the new product with solar heat collectors – reduce annual primary energy consumption on air conditioning by approximately 24% and cut CO2 emissions by about 21% (about 34 tons)\*<sup>1</sup> compared with conventional gas air conditioning systems that do not incorporate solar heat in the case of a 3-4 story building with a total floor space of 4,000m<sup>2</sup>.

The manufacturers will initiate production\*<sup>2</sup> and sales of the new solar absorption chiller heater from this June, while the three gas companies will promote the spread of solar cooling systems incorporating the device to office buildings, schools, hospitals, factories and other customers.



**Figure: Sample System Using the Solar Absorption Chiller heater**

\*1. Trial calculations for a 4,000m<sup>2</sup> tenant building using the solar absorption chiller heater with a 240m<sup>2</sup> solar heat collector, versus a conventional gas absorption chiller heater (COP 1.0, higher heating value standard). The actual energy conservation and CO2 emissions reductions may vary depending on the area of the solar heat collector and the customer air conditioning load.

\*2. The manufacturers will offer models with different air conditioning capacities: Kawasaki

Thermal will initiate sales of 8 models, Sanyo 4 models and Hitachi 17 models.

- \*3. During air heating, the solar heat passes through the hot air heat exchanger and produces hot water.

## **【DETAILED EXPLANATION】**

### **1. Main Product Characteristics**

#### **(1) Maximizes the Use of Solar Heat**

The product allows the use of solar heat at the lowest possible temperatures through such innovations as adding a new solar heat condenser<sup>\*4</sup> and optimizing the coolant path.<sup>\*5,\*6</sup> The unit can effectively utilize solar heat at 75°C at an air conditioning load of 100%, and make use of even lower temperatures at lower loads. For example, the unit can utilize solar heat as low as around 60°C at a load of 30%.<sup>\*7</sup>

#### **(2) Maximizes System Efficiency**

Minimizing the temperatures of the hot water removed from the heat collectors and controlling the radiation of heat into the atmosphere are important keys to increasing the heat collection efficiency of heat collectors. The new solar absorption chiller heater maximizes overall system efficiency by calculating the required temperature ranges for the use of solar heat in accordance with the varying air conditioning load, and keeping the temperature of the hot water removed from the heat collectors as low as possible.

#### **(3) Uses Solar Heat Whenever Possible**

The unit has an internal control for the use of solar heat on a preferential basis. This works to reduce gas consumption volumes and conserve energy.

#### **(4) Stable Air Conditioning Supply Capacity**

The product automatically uses the gas backup to fill air conditioning demand on rainy days with little heat and at other times when solar heat alone is not sufficient to meet the required demand. This secures the required capacity at all times for the provision of stable and comfortable air conditioning.

#### **(5) High Efficiency COP rating of 1.3<sup>\*8</sup> or better**

When operating using gas only, the unit has an air conditioner COP rating of 1.3 or better (equivalent to an electrical air conditioner COP rating of 3.5 or better), with top-level efficiency as a dual use gas absorption chiller heater.

\*4. The solar heat condenser is a device which condenses the refrigerant vapor generated by solar heat.

\*5. The coolant flows through an absorber in regular gas absorption chiller heaters, but passes through the solar heat condenser in this product.

\*6. The three manufacturers are adopting different technologies; this release presents a representative example.

\*7. These are representative figures because the actual figures vary somewhat by manufacturer. The calculations assume a coolant entrance temperature of 25°C under joint use of solar heat and gas.

\*8. Higher heating value standard.

### **2. Development Background**

Air conditioning (heating and cooling) accounts for approximately one-third of commercial use final energy consumption. The three gas companies each conducted demonstration projects<sup>\*9</sup> from FY2009 on the development of solar cooling systems which effectively use solar heat, which is a renewable resource, for the cold water required for air conditioning.

Solar cooling systems to date have used GENELINK waste heat gas absorption chiller heaters, which utilize the waste heat from cogeneration systems (CGS) for the cold water. However, these GENELINK chiller heaters with their established technologies are devices designed for the effective use of stable CGS high-temperature waste heat, so they cannot accommodate the preferential use of solar heat when solar hot water temperatures suddenly change from large variations in the heat collector temperatures due to changes in the weather.\*<sup>10</sup> The new solar absorption chiller heater was specially designed for the effective use of low-temperature solar heat to address this problem and improve the energy conservation effect from solar cooling systems.

The three manufacturers have moved forward with detailed product design and production based on the results of the demonstration research and product specifications examinations conducted by the three gas companies.

\*9. These demonstration projects were conducted by Tokyo Gas at the Nakahara building, by Osaka Gas at the company's pipeline technology center, and by Toho Gas at the Tsu branch office.

\*10. Hot water heated with CGS waste heat maintains a stable temperature of 80°C or higher, but the temperature of solar hot water sometimes falls below 80°C because of fluctuations in sunshine, so the preferential use of solar heat is not possible using GENELINK chiller heaters.

### 3. Basic Product Specifications

		Kawasaki Thermal	Sanyo	Hitachi
Air conditioning capacity range		281-1,055[kW] 80-300[RT]	352-703[kW] 100-200[RT]	422-3,516[kW] 120-1,000[RT]
Rated coolant entrance temperature		31[°C]	31[°C]	31[°C]
Cold water temperature		15→7[°C]	15→7[°C]	15→7[°C]
Range of usable solar hot water temperatures (at 100% air conditioning load)		75-98[°C]	75-98[°C]	75-98[°C]
Gas consumption volume (at 100% air conditioning load)	Gas only	2.68[kW/RT]	2.66[kW/RT]	2.57[kW/RT]
	At rated solar hot water entrance temperature	1.66[kW/RT] (@90 °C)	2.14[kW/RT] (@81 °C)	1.77[kW/RT] (@90 °C)
	Below rated solar hot water entrance temperature	2.33[kW/RT] (@75 °C)	2.32[kW/RT] (@75 °C)	2.44[kW/RT] (@75 °C)

#### 4. Product Photographs



Kawasaki Thermal Product



Sanyo Product



Hitachi Product

#### 5. Development Manufacturer Data

##### (1) Kawasaki Thermal Engineering Co., Ltd.

- Company Outline

Date established	March 10, 1972
Capital	1.4605 billion yen
President	Kazutoyo Daikoku
Business fields	Design, manufacturing, installation, servicing, repair, operating maintenance, sales and rentals of general-purpose boilers, air conditioners, absorption heat pumps and other equipment; design, execution and supervision of civil engineering and building construction; design, execution and supervision of pipeline and electrical construction; other works associated with the aforementioned businesses.
Head office location	1000 Aoji-cho, Kusatsu-shi, Shiga Prefecture

##### (2) Sanyo Electric Co., Ltd.

- Company Outline

Date established	April 8, 1950
Capital	322.242 billion yen
President	Seiichiro Sano
Business fields	Manufacturing, sales, maintenance and service of electric appliances, air conditioners, commercial equipment, semiconductors, etc.
Head office location	2-5-5 Keihan Hondori, Moriguchi-shi, Osaka Prefecture

##### (3) Hitachi Appliances, Inc.

- Company Outline

Date established	April 1, 2006
Capital	20.0 billion yen
President	Takazumi Ishizu
Business fields	Development, manufacturing and sales of comprehensive air conditioning and household appliances
Head office location	2-15-12 Nishishimbashi, Minato-ku, Tokyo