**Basic Concept or Summary**

The major component technologies of this product are shown below.

**Features**

- **Industry-leading energy saving performance**
  The development of an inverter twin rotary compressor with the world's highest capacity and other technologies has reduced annual energy consumption by 58% and CO2 emission by 71% in comparison with gas absorption water chiller-heaters on the assumption that chilling operation is conducted for industrial applications throughout the year.

- **Risk diversification using a unique module-in-module configuration**
  One chiller module consists of four independent refrigerant circuits. If one refrigerant circuit fails and stops, other refrigerant circuits run as backup to continue the operation and alleviate performance degradation. If one refrigerant circuit is conducting defrosting during heating operation, other refrigerant circuits continue the heating operation to alleviate a drop in the water supply temperature.

- **Coexistence of high performance and downsizing using the X-frame structure**
  The X-frame structure, Toshiba's proprietary design, consists of U-shaped air heat exchangers arranged in a V shape. This design has reduced the product footprint by 58% in comparison with chillers 15 years ago while expanding the air heat exchange area. Even if more than one chiller is lined up with little clearance, an air introduction path to the air heat exchangers can be secured, and a maintenance space can also be secured.

- **Wide range of applications**
  All of the compressors, blower fans, and cold/warm water pumps are equipped with inverter control, and the multiple modules including them are controlled for optimal operation in a newly developed group control system. Outlet temperature control and variable flow rate control of cold/warm water have been realized. This system can be used for a wide range of applications from energy-saving air conditioning of varied buildings to objective temperature control at data centers and production process temperature control at factories. It can also be employed to solve problems such as productivity improvement and quality stability.
Effects or Remarks

Examples of reducing effects for primary energy consumption and CO₂ emission for industrial applications
In comparison with gas absorption water chiller-heaters or the combinations of centrifugal chillers and boilers, this system can achieve the energy saving effects shown below even for general air conditioning applications which conduct cooling operation throughout the year.

Examples of reducing effects for primary energy consumption and CO₂ emission for general air conditioning applications
In comparison with gas absorption water chiller-heaters or centrifugal chillers, this system can achieve the energy saving effects shown below even for general air conditioning applications which conduct cooling operation in summer and heating operation in winter.

Received awards
 Fiscal 2011: Minister Prize of Economic, Trade and Industry in Energy Conservation Award
 Fiscal 2011: Technology Award from Japan Society of Refrigerating and Air Conditioning Engineers
 Fiscal 2011: Promotion Foundation for Electrical Science and Engineering Award from the Promotion Foundation for Electrical Science and Engineering
 Fiscal 2013: Environment Minister's Award for Global Warming Prevention Activity
 Fiscal 2014: Energy Winner Award from Citizens‘ Alliance for Consumer Protection of Korea

Installation in Practice or Schedule

Domestic
Toshiba Carrier Corporation enjoys the highest market share of module-type heat pump chilling units that are well received by the market due to their high-efficiency operation and risk distribution feature. More than 24,000 units have been shipped so far. They have been delivered to more than 1,800 companies such as an electrical equipment manufacturer in Yamagata pref., machine tool manufacturer in Hyogo pref., transport machine manufacturer in Aichi pref., machine component manufacturer in Niigata pref., electronic component manufacturer in Gifu pref., nursing home in Akita pref., and data center in Tokyo. For example, the use of boilers can be lessened to reduce the CO₂ emission in constant-temperature and constant-humidity air conditioning by having cooling and heating coexist in one module group and thus achieving perfect heat source conversion as shown in the figure on the right. This method not only reduces the CO₂ emission but also simplifies operation and maintenance.

Overseas
In 2014, this system started to be exported to Korea on a full-fledged basis and 20 units have been delivered to hospitals, hotels, etc. Furthermore, overseas sales are expanding mainly for use by Japanese companies in Asia and Europe.

Contact: Toshiba Carrier Corporation, Products Planning Dept.
Tel: +81-44-331-7414
URL: http://www.toshiba-carrier.co.jp