Messages from Modern Inventors to the Next Generation

Season 2

1. *EcoCute, a water heater using atmospheric heat*

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Due to the significantly serious issue of global warming, environmental concerns have been increasing, and we have been flooded with environmentally friendly "eco goods."

EcoCute is one of these environmentally friendly products. The name is formed by combining "eco" from the words "ecology" and "economy" with the Japanese word "給湯" which can be pronounced "kyuto" (sounds like "cute") but literally means hot-water supply.

This first relay message of Season 2 was created by Mr. Sakakibara of Denso Corporation. He tells you what motivated him to develop EcoCute as well as some of his tough experiences in developing the product.

Introduction of the product/technology

Do you know how much energy is needed to boil water which is used when taking a bath or a shower and doing many daily chores? In fact, one third of the total amount of energy used in a standard home per day for air conditioning, television, lighting, etc. is used only to boil water. The "EcoCute" I am introducing here is an energy-saving water heater which is capable of boiling water by using heat and a small amount of electricity contained in the surrounding air. With its high-performance function, EcoCute has recently been attracting a great deal of attention as an effective apparatus for combating global warming, which is one of the most serious issues in recent

years.

What inspired you to invent or develop the product/technology?

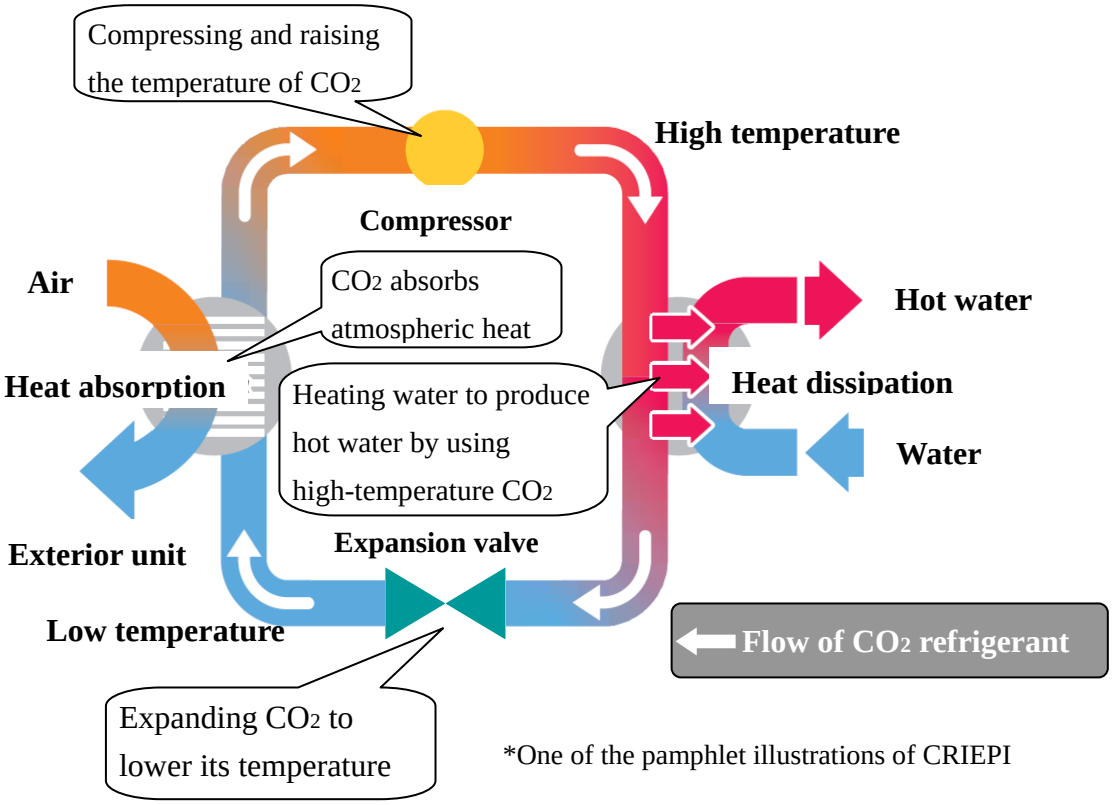
I started developing an “EcoCute” system in 1997 when the Kyoto Conference on the Prevention of Global Warming was held and the world began to pay more attention to technology to save energy and prevent global warming. My current employer, Denso Corporation, is an automobile parts supplier developing and manufacturing products for cars. In the field of air conditioners for cars, Denso has more than 30% of the global market share. I have actually been involved in a study on the use of carbon dioxide (CO_2), which is an environmentally friendly future component of car air conditioning systems, as the use of CO_2 contributes less to global warming than the conventional use of chlorofluorocarbon (CFC). Therefore, the Tokyo Electric Power Company (TEPCO) and the Central Research Institute of Electric Power Industry (CRIEPI) kindly asked us to join them in developing a water heater with a heat pump system that produces hot water by using CO_2. It was at that time that I learned for the first time that water heaters used one third of the total amount of energy in a home and thus successful development of water heaters would be one of the effective ways of preventing global warming. Although this field was completely new to Denso, we decided to take advantage of the opportunity and become part of the trilateral joint development project.

CO_2 is normally considered to be a substance that aggravates global warming. It is usually disposed into the air or frozen to make dry ice (and eventually disposed into the air anyway) after being emitted when raw materials for industrial commodities are prepared. Under the EcoCute system, however, CO_2 is effectively utilized. Isn’t it a very interesting idea to create a technology for preventing global warming by utilizing CO_2 which is generally regarded as one of the major causes of global warming?

What specific ideas and difficulties have you faced in inventing or developing the product?

In order to most effectively use CO_2 as a cooling medium (a substance giving off heat) of a heat pump water heater, supercritical CO_2 (CO_2 in a state of neither gas nor liquid due to ultra-high pressure) has to be given heat while being continuously in contact with water that gradually increases in temperature from cold water to hot water. Otherwise, the water heating system is not able to produce hot water. However, this idea did not apply to the conventional type of heat pumps which did not use supercritical CO_2. So, I first of all tried to fully understand what was occurring in the state of supercritical CO_2. We conducted various experiments under different conditions and then sorted out the results to form another hypothesis. This experimental cycle was repeated. As a result, it was finally discovered that the optimal state of supercritical CO_2 can always be created in

the most appropriate manner throughout the year (e.g., winter to summer), by adjusting the CO_2 pressure according to the temperature of the heat exchanger which produces hot water. In order for the product to be successfully commercialized, added to this technology, a heat exchanger had to be developed that was highly efficient despite the very high pressure of CO_2 and the big difference in CO_2 pressure. In this connection, we made and tested trial products repeatedly in order to improve them. The EcoCute was completed as a product due to the involvement of a large number of people and their efforts.



*One of the pamphlet illustrations of CRIEPI

What gives you joy as an inventor/researcher/developer?

When I became involved in the EcoCute development, I could not help paying attention to water heaters installed in the exterior walls of houses even when taking my dog for a walk in the neighborhood. I often “carefully” peeped into narrow spaces between houses in order to find out what kind of water heaters were installed and in what way they were installed. My fellow researchers did the same. Realizing that this practice was almost an occupational disease, we used to laugh about what we were doing. The members dealing with the technologies and products gathered together and had intense discussions with co-researchers of TEPCO and CRIEPI from morning till night to finally complete the world’s first home CO_2 refrigerant heat pump water heater “EcoCute” in April 2001. We were deeply moved when the product, which had not existed before, was brought into the world by drawing upon the knowledge and ideas of all project members and

overcoming the problems one by one.

We develop technologies useful to society, and the products, which reflect our own ideas, are welcomed by consumers. This is the best possible situation for engineers, and therefore, all engineers should be able to enjoy this kind of experience. In order to achieve something, you must always be interested in various things, collect much information, and think for yourself. Once you have the opportunity, take it without hesitation. Then you will certainly enjoy a sense of accomplishment. Go for it!

Photo: Present type of EcoCute