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**MITSUBISHI ELECTRIC ACHIEVES DOMESTIC TOP-LEVEL  
ENERGY EFFICIENCY OF 83% WITH P.E.F.C. CO-GENERATION  
SYSTEM**

*Using a Lossnay® humidifier enable high performance and low cost*

**TOKYO, Feb. 17, 2004** — Mitsubishi Electric Corporation (President and CEO: Tamotsu Nomakuchi) has successfully developed a PEFC (Polymer Electrolyte Fuel Cell) co-generation system using a Lossnay<sup>1</sup> humidifier. A high level (by domestic Japanese measures) electrical efficiency of 34% was achieved, while overall energy efficiency<sup>2</sup> was 83%, with heat recovery. The system was developed and reliability tested with DSS (Daily Start & Stop), and cold-weather operations needed for home and business use over the long-term, in mind.

Development of the Lossnay humidifier and the molded separator which are the key components of the system was carried out with NEDO (New Energy and Industrial Technology Development Organization) funding.

<sup>1</sup>Lossnay: method of heat and humidity and humidity exchange using special processing paper. Lossnay ventilators are available for both commercial installations and residential use. "Lossnay®" is a registered trademark of Mitsubishi Electric Corporation.

<sup>2</sup>Overall energy efficiency: the ratio of electricity or heating value to the calorific value of the fuel. In the co-generation system, both electricity and heat generated from the fuel cell are used and the overall energy efficiency is defined as the ratio of total power generation of electricity and hot water supply to fuel input.

## **Background**

In order to reduce society's energy costs, distributed power supplies that generate electricity nearby to homes, shops and offices are expected to become increasingly common. In particular, fuel cells have received considerable attention as a means of reducing the detrimental effects of electricity generation on the global environment. The fuel cells method of generating electricity via the reaction of hydrogen and oxygen does not require the harmful emission of carbon dioxide. The attraction of PEFC is that it has no need of costly anti-corrosive materials as it operates at lower temperatures compared to alternative fuel cells. Also, the polymer electrolyte membrane is non-caustic. Development of a PEFC co-generation system suitable for home and business use is at an advanced stage. Ensuring that the system is of low cost, lasts for a long time, is highly reliable and that it meets the DSS and cold-weather operation requirements are the most factors in determining whether the system becomes widely used.

The Lossnay humidifier is an indispensable component of the PEFC co-generation system, enabling the system to be simplified and to achieve a high performance.

## **Main Features**

### *1. High-level electric efficiency (34%) and overall energy efficiency (83%)*

The PEFC system construction was simplified and its performance was improved using a Lossnay humidifier as a key component. A high level (by domestic Japanese measurements) of electric efficiency (34%) and overall energy efficiency (83%) with heat recovery were achieved.

### *2. Development of specific key components aimed at the production of a low-cost PEFC*

Molded separators made from heat-stiffened resin and carbon were used to control fuel and air flow in the fuel cell stack. A huge cost reduction of 1/100 compared to the previous separators was achieved, which translates to a unit cost of 200 yen for an order of one million units. In addition, the use of the Lossnay humidifier enabled the miniaturization of the heat exchanger and an expensive de-ionized water filter unit.

### 3. *Original long-life reformer*

In a reformer, the thermal fatigue of its reactor tubes as a result of repeated stopping and starting, and operation at high temperatures of 700°C to 900°C is a common problem. An expensive heat-resisting alloy can be used to combat this problem. However, this time a tougher and cheaper reformer made of general-purpose stainless steel was developed. Its strength was confirmed by carrying out 1500 heat cycle tests. As a result, the PEFC system is able to conform to the requirements of DSS operation.

### **Future Developments**

Further cost reduction measures, developments to make the fuel cell stack last longer and more durability and reliability tests of the system will be carried out in the future. Moreover, a 10kW class system will be developed for business usage, using the 1kW class system as a prototype.

### **Patents Pending**

Fifty-one patents related to this development are currently pending in Japan; four patents are currently pending abroad.

### **About Mitsubishi Electric**

With over 80 years of experience in providing reliable, high-quality products to both corporate clients and general consumers all over the world, Mitsubishi Electric Corporation (TSE: 6503) is a recognized world leader in the manufacture, marketing and sales of electrical and electronic equipment used in information processing and communications, space development and satellite communications, consumer electronics, industrial technology, energy, transportation and building equipment. The company has operations in 35 countries and recorded consolidated group sales of 3,639 billion yen (US\$30.3 billion<sup>\*</sup>) in the year ended March 31, 2003. For more information visit <http://global.mitsubishielectric.com>

<sup>\*</sup>At an exchange rate of 120 yen to the US dollar, the rate given by the Tokyo Foreign Exchange Market on March 31, 2003.

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