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Mitsubishi Electric Develops New Compact and Highly Efficient EV Power Conditioner Technology

Optimizes home consumption of surplus electricity generated by domestic PV systems and will supply stable back-up power during blackouts

TOKYO, January 29, 2020 – Mitsubishi Electric Corporation (TOKYO: 6503) announced today that it has developed new miniaturization and energy-efficient technologies for electric vehicle (EV) power conditioners, which will greatly facilitate the domestic use of the electricity stored in EV batteries. The use of these technologies in the creation of a prototype power conditioner allowed its size to be reduced to approximately one half that of comparable existing models* while achieving approximately 30 percent less power loss.** Their compact design will enable the conditioners to be installed in confined spaces such as domestic garages, facilitating their deployment in typical home environments.

The newly developed technology facilitates the domestic consumption of surplus electricity generated by residential photovoltaic (PV) systems as well as offering homes a stable power supply in the event of a blackout. Going forward, Mitsubishi Electric plans to mass-produce small high-efficiency power conditioners for EVs, thereby contributing to the realization of a low-carbon society through the increased use of renewable energy.

* SMART Vehicle to Home (V2H) EVP-SS60B3-M7/Y7/Y7W
** Reduction of power conversion loss at low power output (0.5 kW)

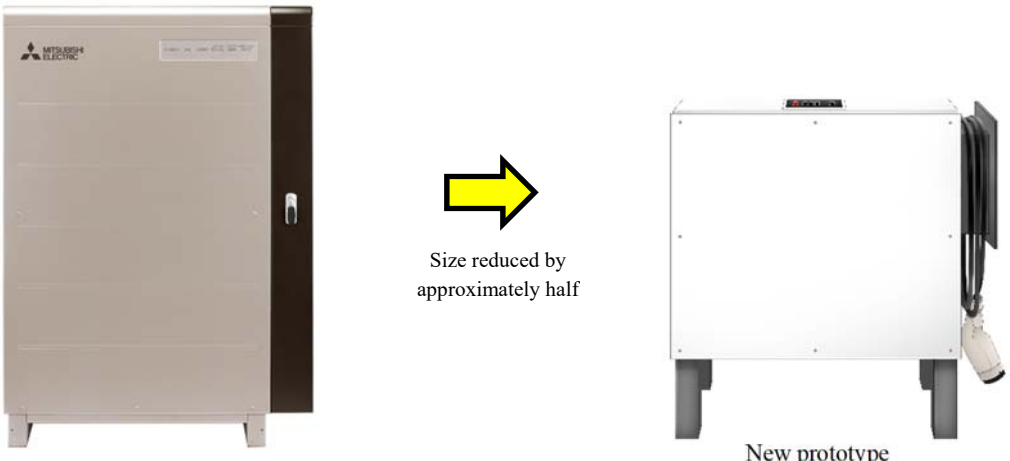

Fig. 1 Size comparison of existing EV power conditioner and new prototype

Key Features

1) High-speed switching and improved circuitry achieve a size reduction of almost 50 percent

EV power conditioners consist primarily of a DC/DC converter and an inverter that converts DC to AC to allow the charging and discharging of the EV's batteries. These converters and inverters have inductors for transmitting electricity to EVs and power lines, which account for much of the size of the power conditioners. Inductors play a role in removing high frequency components of the pulse voltage, allowing stable operation of the component systems. The size of the inductor is determined by the period and amplitude of the pulse of the input voltage; it is thus possible to reduce this by reducing the input voltage and shortening its pulse period.

With this latest development, Mitsubishi Electric has created a solution capable of high-speed switching of the power semiconductor devices used in DC/DC converters, enabling operation with shorter pulse periods (Fig. 2 and 3). In addition, suppression of the voltage fluctuations that accompany the switching of power semiconductor devices allows the use of a three-level inverter circuit in the inverter (Fig. 2). This can reduce the amplitude of the voltage below that of a conventional two-level inverter circuit, allowing a reduction of the input voltage to the inductor connected to the output side of the circuit (Fig. 4). This allows the inductor to be miniaturized, and in conjunction with the optimized placement of components, facilitates a reduction in the size of the overall power conditioner of almost 50 percent.

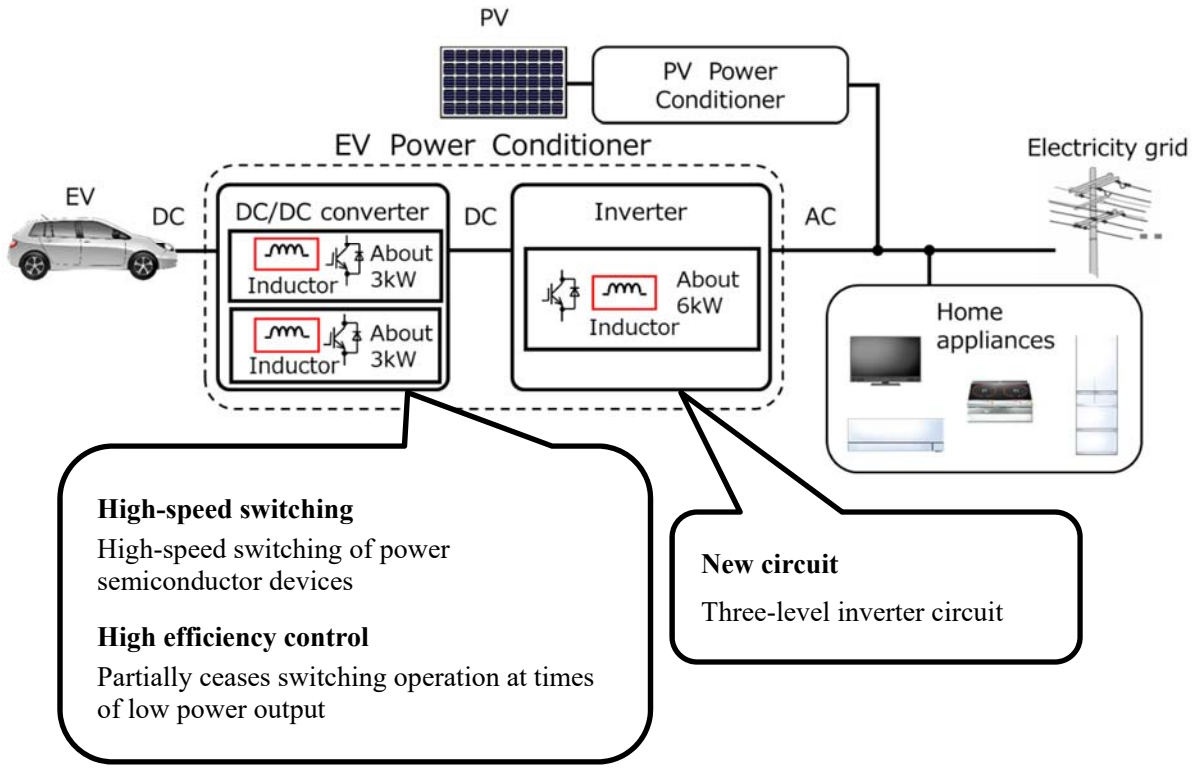

Fig. 2 Configuration of new EV power conditioner

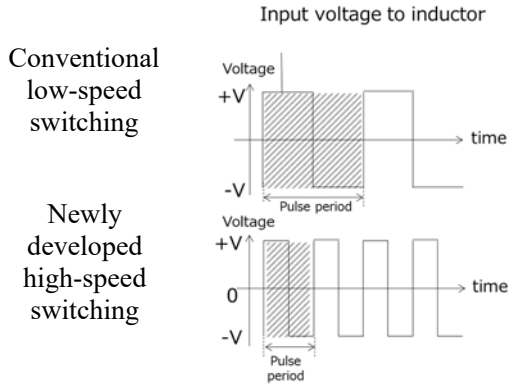

Fig. 3 Switching of power semiconductor devices

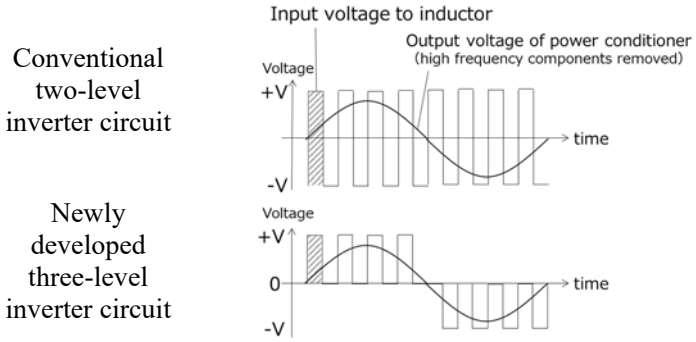

Fig. 4 Reduction in the amplitude of input voltage

2) ***High-efficiency control technology reduces power loss***

When EV storage batteries are used in standard homes, typical power consumption is less than 1 kW. Reducing power loss at these levels enables the effective utilization of surplus electricity generated by the PV and stored in the EV's batteries, resulting in a reduction in the electricity needed to be purchased by the home owner. The new technology is capable of highly efficient control of two DC/DC converters with an output of 3kW. When power output is low, the system uses only one of the converters and partially stops the switching of the active converter's power semiconductor devices. As a result, the power loss of power semiconductor devices at outputs of 1 kW or less can be reduced by approximately 30 percent.

Background

Since November 2019, electric power companies in Japan have been gradually phasing out their "Feed-In Tariff" programs, whereby they purchase electricity generated by renewable household energy sources at a specific price. As a result, household consumption of surplus electricity generated by consumers' own residential PV system is expected to increase, and EV batteries are an ideal solution for storing electricity for domestic use. There is also a growing need for the use of EVs as emergency power sources during blackouts. Power conditioners for EVs that convert DC to AC are indispensable when electricity stored in EVs is to be used in homes. However, the difficulty of housing the necessary equipment in confined spaces and the power loss occurring when using the electricity stored in EVs were until now issues preventing their wider deployment.

Contribution to the Environment

The power loss of power semiconductor devices at power outputs of 1kW or less can be reduced by approximately 30 percent; this will contribute to the realization of a low carbon society through the more efficient use of renewable energy.

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About Mitsubishi Electric Corporation

With nearly 100 years of experience in providing reliable, high-quality products, Mitsubishi Electric Corporation (TOKYO: 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. Embracing the spirit of its corporate statement, Changes for the Better, and its environmental statement, Eco Changes, Mitsubishi Electric endeavors to be a global, leading green company, enriching society with technology. The company recorded a revenue of 4,519.9 billion yen (US$ 40.7 billion*) in the fiscal year ended March 31, 2019. For more information visit:
www.MitsubishiElectric.com

*At an exchange rate of 111 yen to the US dollar, the rate given by the Tokyo Foreign Exchange Market on March 31, 2019