

【Grant-in-Aid for Scientific Research (S)】

Science and Engineering (Engineering)



Title of Project : Realization of Sustainable Green Society Through 99.9% Class Efficiency Electric Power Conversion

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Research Project Number : 17H06147 Researcher Number : 80186139

Research Area : Electrical and Electronic Engineering

Keyword : Power conversion, Power electronics, High efficiency inverter

【Purpose and Background of the Research】

One of fundamental key technologies for realization of sustainable industrial society is ultra-high efficiency electric power conversion technology, which enables the super energy saving and increases the more use of renewable energy.

The goal of this project is that it will be experimentally proved that a 5 kw 99.9 % efficiency class inverter can be realized, and using it almost free allocation of distributed energy generators can be realized in the power distribution system.

In the 1st stage, realization of 99.9% class efficiency single-phase inverter will be challenged, and in the 2nd stage, three-phase inverter will be realized at 99.9% class efficiency. Third, it will be experimentally proved that using the above inverter a rapid energy control of PV system is possible. Forth, using this result, it will be verified that super high efficient energy control between the electric vehicle battery and the solar power system is possible. In the final stage, a new concept for the electric power distribution system will be proposed based on the obtained new knowledge.

【Research Methods】

To realize an ultra-efficient flexible energy flow in the low voltage electric energy distribution system, this project is divided into five subtasks, in which five different targets are clearly defined. One of the key targets is the realization of 99.9 % class efficiency inverter, which is made of two parts. One is a high efficient chopper circuit based on the principle of partial power conversion, and the other is turning-up circuit as shown in Fig. 1. The former aims at the reduction of switching loss and the latter targets the conduction loss reduction.

【Expected Research Achievements and Scientific Significance】

The renewable energy has inherent fluctuation within a short period, and a special care is required for the stable operation and voltage regulation of an electric power system. A few kW inverter with 99.9% class efficiency can solve this problem if a rapid energy flow control is realized in the low voltage power distribution system. This technology can be widely applicable for any power conversion field, and one typical example is targeted for a proposal of new power distribution system including renewable energy, which will be one of the basic technologies for the sustainable industrial society.

【Publications Relevant to the Project】

- (1) K. Aoyama, N. Motoi, Y. Tsuruta, A. Kawamura, "High Efficient Energy Conversion System for the Decrease in the Battery Terminal Voltage of Electric Vehicles", IEEJ Journal of Industry Applications, Vol.5, No.1, pp.12-19, 2016
- (2) Y. Hosoyamada, M.Takeda, T.Nozaki, A.Kawamura, "High Efficiency Series Chopper Power Train for Electric Vehicles Using a Motor Test Bench", IEEJ Journal of Industry Applications, Vol.4, No.4, pp.460-468, 2015

【Term of Project】 FY2017-2021

【Budget Allocation】 138,000 Thousand Yen

【Homepage Address and Other Contact Information】

<http://www.kawalab.dnj.ynu.ac.jp/>

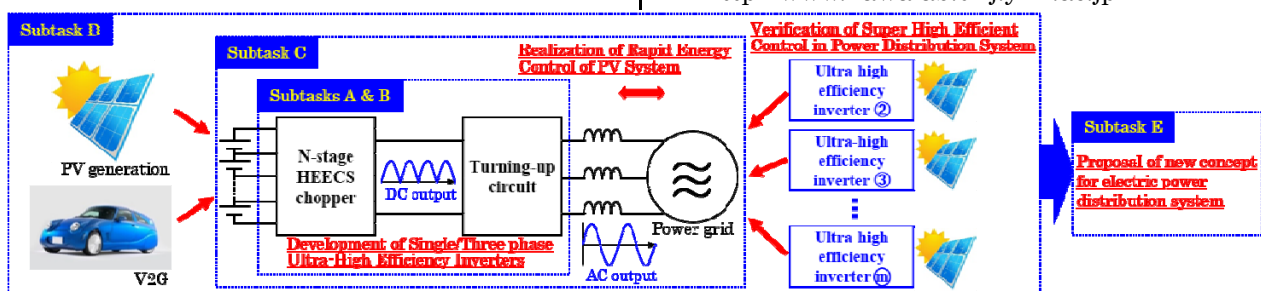


Figure 1 Proposed system configuration and research subtasks