RECENT RESEARCH ACTIVITIES

Wireless power transfer for flying drone with novel beam forming

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Our laboratory joins a Cabinet Office Cross-ministerial Strategic Innovation Promotion Program (SIP) named "Energy system of an Internet of Energy (IoE) society" from FY2018[1]. This subject realize an Internet of Energy(IoE) society with Society 5.0 era energy systems. We are involved in sub-theme of "R&D for application/practical implementation of IoE" presents the form of a super-smart, resilient IoE society. It develops wireless power transfer (WPT) systems for indoor sensor networks and mobile information equipment as a practical example of implementation. We are developing a drone WPT systems via microwave. In FY2019, we showed the following novel research results; 1) novel beam form to maximize total WPT efficiency which includes a beam efficiency between a transmitting antenna array to a receiving antenna array and microwave-electricity conversion efficiency which has input microwave power dependence[2], 2) new diode parameter estimation method with only S_{11} (reflection) parameter for a rectifier in a receiver[3], and 3) estimation of effect of the microwave beam to conventional wireless communication system. We will apply the WPT technologies for future IoE society toward a sustainable humanosphere.

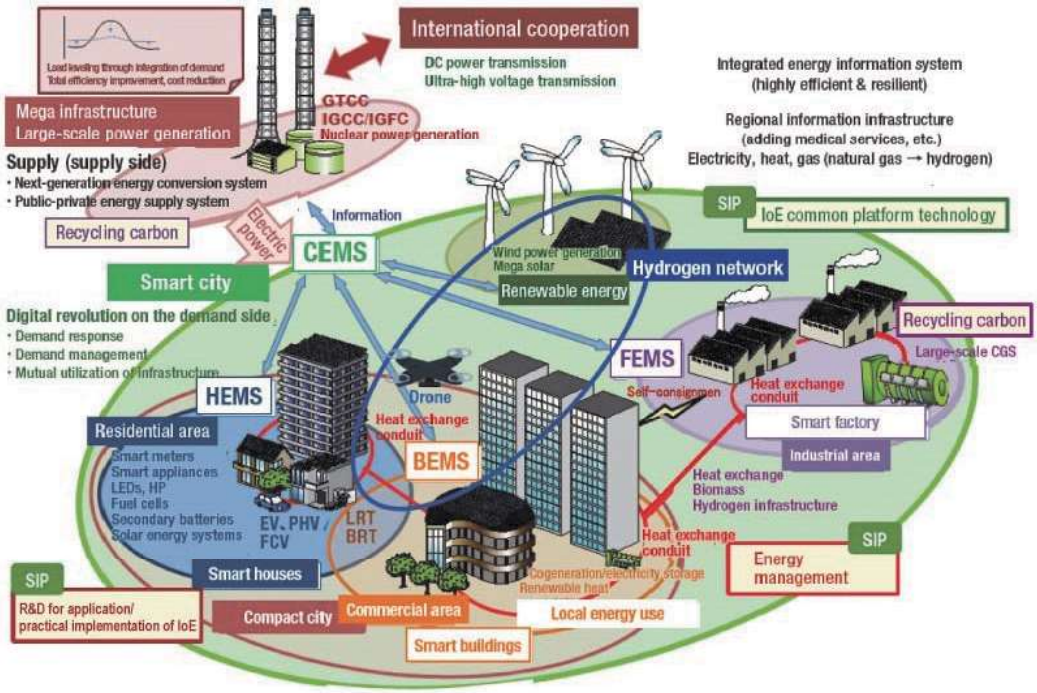

Fig. 1. Grand design for the energy system of an IoE society[1]

References

[1] SIP "Energy system of an Internet of Energy (IoE) society" https://www.jst.go.jp/sip/en/p08/index.html

[2] N. Takabayashi, et al. "Rectification Improvement With Flat-Topped Beams on 2.45-GHz Rectenna Arrays", IEEE-Trans. MTT, Vol.68 , No.3 , pp.1151-1163 , 2020.

[3] T. Hirakawa, et al., "The Method of Diode Modeling and Novel Equivalent Circuit for Microwave Rectifiers", Proc. of 2019APMC, pp.1164-1166, 2019.