

In order to realize an Internet of Energy (IoE) society with Society 5.0 era energy systems, we will consider designs for energy systems of a society where renewable energy is the main energy source, build energy systems contributing to optimization of energy use, implement R&D toward achieving innovation in energy conversion and transmission systems that are the component technologies for that, and implement this in society.

Goals

From the perspective of making renewable energy the main source of energy, we will show a grand design for energy systems in an IoE society toward implementation in society, and work on building a data linkage platform targeting subjects such as energy data analysis. In Theme (B), which is common platform technologies to realize the grand design, we develop the universal smart power module (USPM) that enables optimal response to load fluctuations and input voltage fluctuations by achieving minimization of designs for each use and over 600 V, and also develop next-generation semiconductor substrates focusing on application in wireless power transmission (WPT) systems. In Theme (C), as a practical example of implementation in society of devices developed in Theme (B), we will develop WPT systems for 3 type applications; WPT system for indoor sensor networks and mobile information equipment, WPT system for speeds of 60 km/h and 90% power feeding efficiency for in-moving electric vehicles (EVs), and WPT systems for in-flight drones focusing on diverse uses.

Exit strategies

After completion of the project, together with promoting construction of systems based on the grand design for the presented energy systems, the R&D results will be commercialized centered on the participating companies, and initiatives will be implemented for formulating technical standards and international standardization, leading to international expansion from commercialization.

Socioeconomic impact

- Conserve energy through the spread of electronics adopting USPM. Evaluate results of promotion of use of variable power sources.
- Improve designs and productivity for everything in society through making power supply wireless. By promoting the spread of EVs through WPT, renewable energy will be promoted as the main energy source.

Toward achievement

R&D content

(A) Design an energy system for an IoE society

- Design of energy management systems of an IoE society in which distributed energy resources such as photovoltaic systems (PV), storage batteries, hydrogen power generators, and EVs are connected through power electronics.
- Build a data linkage platform realizing sector coupling including for energy, transportation, hydrogen, thermal, etc. through data cooperation in many fields and universal power supply.

(B) IoE common platform technology

In order to develop the USPM with high functionality and general purpose at a low cost enabling extremely efficient response to variable energy sources such as renewable energy, development is carried out for ① high-speed digital controller for wide band gap (WBG) semiconductors, ② core module that operate at high power density and high temperatures, and ③ the metal-oxide-semiconductor field-effect transistor (MOSFET) that realizes low loss at the same level as silicon carbide (SiC) at about the same cost as silicon (Si), as a WBG switching device.

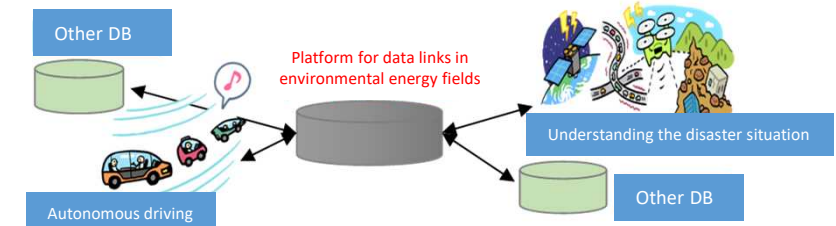
In addition, with a view to application in WPT systems, development is carried out for basic technologies focusing on GaN devices for electro-magnetic coupling type WPT systems using MHz bands and radiation-type WPT systems using microwaves.

(C) R&D for application/practical implementation of IoE

Toward realizing energy management using safe WPT technologies; long range, high efficiency, and high power, development is implemented for optimizing transmitters and receivers in WPT systems and advanced transmission control technologies, and development is also carried out for ① WPT systems for indoor application, ② Dynamic WPT systems for in-moving EVs, ③ WPT systems for in-flight drones used for infrastructure maintenance and management, etc.

We aim to establish safe WPT systems with unprecedented long range, high efficiency, and large power.

● Illustration of data links necessary for optimal energy management



● Illustration of an example energy conversion/transmission system

