

## Press Release

April 26, 2013

Murata Manufacturing Co., Ltd.

dSPACE Japan K.K.

K.K. Smart Energy Laboratory

### **Trials Begin of Energy System for Next-Generation Smart Houses**



Smart Cell

#### **Summary**

Murata Manufacturing Co., Ltd. (based in Nagaokakyo; president: Tsuneo Murata, hereafter Murata Manufacturing), dSPACE Japan K.K. (based on Shinagawa-ku, Tokyo; president: Hitoshi Arima, hereafter dSPACE Japan), and K.K. Smart Energy Laboratory (based in Sunto-gun, Shizuoka Prefecture; president: Soichiro Nakamura, hereafter Smart Energy Laboratory) developed a prototype energy system for next-generation smart houses, installed the system in the Smart Cell constructed by the Yokohama Smart Community in the tvk Housing Plaza Yokohama, and began trial operation. Through these trials, the three companies will assess the reliability of the energy system, identify consumer needs, and investigate the required performance and reliability of the energy system as well as the modules and electronic parts of the equipment. The three companies also plan to conduct a feasibility study on development of technologies necessary for future energy markets and the deployment of new products.

## **Background**

The use of photovoltaic panels to charge household storage batteries and electric cars has become increasingly common in households as a result of various factors including electricity shortages and high fossil fuel prices. The development of energy systems that can satisfy needs and operate stably, efficiently, and flexibly under these use conditions is needed. Specific development includes equipment that can support grid power using electricity generated by solar cells and from household storage batteries during the daytime in the summer when there are shortages of grid power, as well as equipment that can charge electric vehicles by combining grid power and electricity from storage batteries. Achieving this will require integrated management of equipment including highly responsive digital power supply controls (such as bidirectional DC-DC converters and bidirectional DC-AC inverters).

Murata Manufacturing, dSPACE Japan, and Smart Energy Laboratory combined their respective strengths and played the roles described below to develop a next-generation energy system that can meet these needs.

## **Roles of Each Company**

- **Murata Manufacturing:** Developed next-generation (autonomous collaborative) energy system testing equipment using the world's first model-based development methods based on the next-generation smart house concept proposed by the Yokohama Smart Community.
- **dSPACE Japan:** Provided a prototyping system that can quickly mount control logic circuits on equipment and model-based development methods and equipment such as simulators for verifying results. Contributed to raising quality and reducing the development period.
- **Smart Energy Laboratory:** Provided Consulting on energy system concepts, system structures, control models, and other aspects of the system based on its extensive experience in digital power supply development.

## **Configuration of the Energy System**

The energy system supports home energy management system (HEMS) interface functions. This means that the system can receive commands directly from an HEMS-compatible home server or home monitor on how to distribute grid power and electricity from solar cells or storage batteries to household appliances and control energy usage through bidirectional DC-DC converters and bidirectional DC-AC inverters. As a result, it is possible to control the system to create, store, and intelligently use energy, all requirements for a smart house, and make energy control visible for efficient energy use.

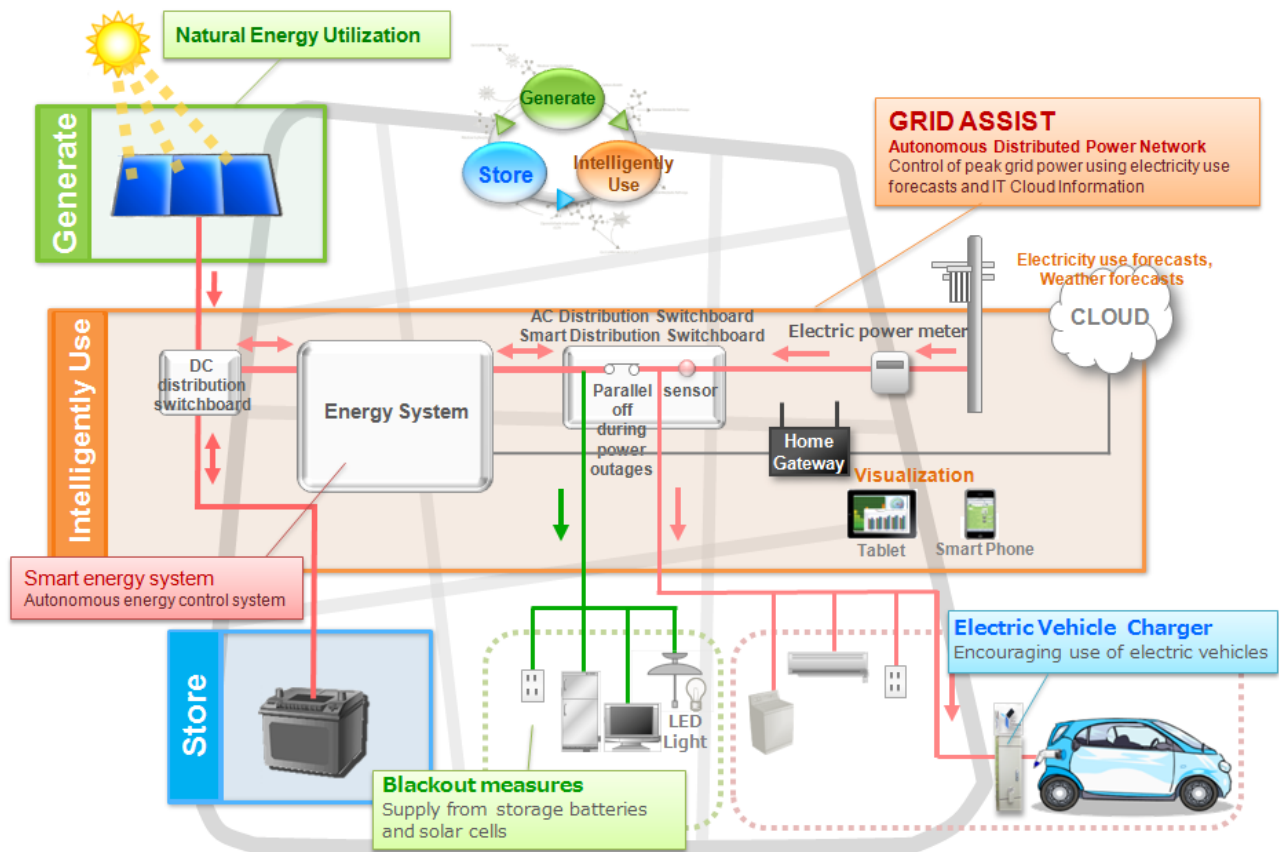


Figure 1. House with an Energy System for Next-Generation Smart Houses (conceptual)

## Energy System Specifications

Photovoltaic cells, storage batteries, grid power, and so on are integrated as a system to enable bidirectional energy control, exchange, and monitoring.

Electrical specifications

- Rated output: 3 kW (grid-tie and autonomous operation)
- 2-channel input (2 channels for photovoltaic cells or 1 channel for photovoltaic cells and 1 channel for fuel cells or other input)
- Storage batteries: 2 kWh

Functions

- Grid power support including autonomous operation during a power outage, peak cut, and peak shift
- Intelligent energy system that can respond flexibly to all circumstances (in consideration of future systems too)
- Makes household electricity consumption and photovoltaic cell output visible and uses cloud data (weather forecasts, electric power forecasts, etc.)



Figure 2. Energy System for Next-Generation Smart Houses

### **Trial Demonstration**

The trial equipment of the energy system will be installed and operated in the smart cell constructed by the Yokohama Smart Community in the tvk Housing Plaza Yokohama. The smart cell will be open to the public starting April 26, 2013.

### **Model-Based Development**

Model-based development is a development technique that confirms the actions of software and other system components using simulations. It is commonly used with aircraft and automobile electronic control development equipment. Adapting this technique to development of household energy system equipment contributed to higher system quality and a shorter development period.

It is known that as system components are added, the work times for each development and verification process and system testing increase exponentially. In the automobile industry, model-based development is used to solve this problem and raise product quality and development efficiency, and this development technique is becoming the norm. In household energy control systems for smart houses, similar issues arise as a result of the need to use diverse digital power supply technologies for stable and efficient energy control, and by adopting the established model-based development technique, it is possible to create an optimal development environment. The dSPACE prototyping system can automatically load numerical models created by MATLAB/Simulink from The MathWorks and operate in real time. In addition, program code is automatically created from the generated model and loaded. dSPACE Japan provides hardware-in-the-loop simulators (HILS) as technology for simulating the grid and can perform trials of the actual energy system comprising hardware and simulation models that can create grid conditions and operate as a grade-tie simulation.

## **Yokohama Smart Community**

The Yokohama Smart Community (representative: Hitoshi Arima), which was established on June 14, 2011, engages in activities designed to establish a community that pursues lifestyles that use energy without imposing any ordinance on the environment based on the principle of "create communities that support lifestyles and culture through science and technology while learning from and using nature." Businesses and organizations that agree with and support this principle assembled and began activities. Currently, the Community membership includes 82 companies, five research organizations, and six advisors. The Yokohama Smart Community seeks to create secure and enriching communities. Members of the Community believe that leading enriching lives requires not technological solutions, but the pursuit of the communities that we truly want and lifestyles that use energy in harmony with nature and without burdens on the environment. They also believe that the skillful use of natural energy and the creation of low-cost, flexible energy systems will lead to reductions in carbon dioxide emissions and solutions to problems such as food shortages.

## **Smart Cell Project**

The Smart Cell Project was launched as a model house construction project to serve as a testing site by members based on the Yokohama Smart Community fundamental principles and to publicly disseminate information in Japan and internationally concerning concepts and testing results. The Smart Cell is a research and trial site for fostering natural environments, arts, and culture as well as diets and healthcare that support healthy lifestyles and pursuing community models that seek energy use and cyclical social systems that do not impose burdens on the natural environment. The Smart Cell is a future-oriented model house construction project for member companies and organizations of the Yokohama Smart Community to contribute their construction materials, equipment, and so on for achieving these objectives. Concepts will be adopted from a wide range of fields including the environment, construction, furniture, household appliances, broadcasting, distribution, healthcare, food, energy equipment, the arts, and culture to create appealing results. Information concerning the results will be promptly distributed in Japan and overseas, and by identifying future needs and disclosing methods of resolving issues, it is expected that the project will lead to the creation of markets and development of new business models.

## **About Murata Manufacturing Co. Ltd.**

Murata Manufacturing is a global comprehensive electronic components maker that has been developing and marketing a diverse range of electronic components that make use of the electrical properties of ceramics since its foundation in 1944. With "Innovator in Electronics" as its slogan, Murata Manufacturing has created many original products and supported all types of electronic equipment. Murata Manufacturing will continue its efforts to support safe and comfortable lifestyles in numerous fields

including automobiles, the environment, energy, and healthcare, and to contribute to the development of global culture. <http://www.murata.com/>

### **About dSPACE Japan K.K.**

dSPACE is the world's leading provider of hardware and software tools for developing and testing sophisticated electronic control systems. For over 20 years, dSPACE's high-quality, off-the-shelf software and hardware tools have empowered engineers to design and innovate, while dramatically reducing development time and cost. dSPACE's pioneering products such as the MicroAutoBox rapid prototyping systems, hardware-in-the-loop (HIL) simulators, and the automatic production code generator TargetLink have become de facto standards for developing automotive electronics. dSPACE technology also has a great impact on aerospace, medical engineering, industrial automation, electric drives technology and other industries. Academia also uses this technology to nurture engineering talent. Through its headquarters in Paderborn, Germany, as well as its global network of project centers, subsidiaries and distributors, the dSPACE staff of over 1,000 supports innovations all over the world. [www.dspace.com](http://www.dspace.com)

### **About K.K. Smart Energy Laboratory**

Smart Energy Laboratory was established in October 2009 to conduct research on energy systems from the bioperspective of creating, storing, and intelligently using energy in a small world with the aim of creating a sustainable, low-carbon society. It is currently using dSPACE's advanced model-based development techniques to conduct research on autonomous and dynamic energy systems. It also provides consulting on achieving harmony between nature and energy in communities and the construction of smart energy systems. Smart Energy Laboratory is putting particular effort into fostering human resources who can develop and design energy systems and actively conducting educational programs to support energy system development including collaboration with multiple universities, holding specialized seminars, and developing and marketing educational materials. In addition, Smart Energy Laboratory launched the Fukuoka Smart House Consortium in June 2010 as a smart energy test site and is now cooperating with dozens of companies on trials of complex energy systems. The PowerSel series was planned to foster model-based development engineers involved in smart energy-related work.

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